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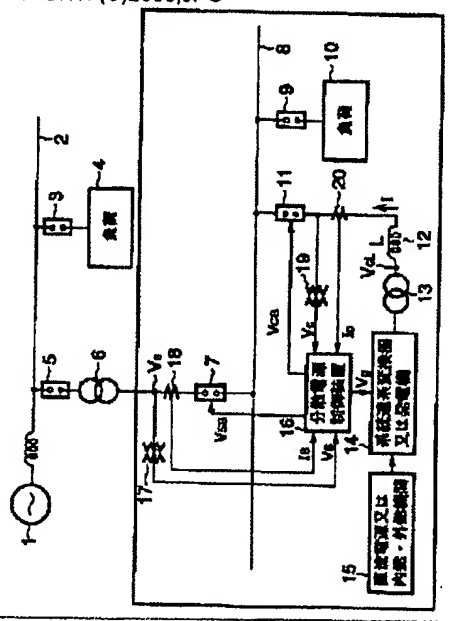
(54) **DISTRIBUTION POWER SUPPLY SYSTEM**

(57) Abstract:

PROBLEM TO BE SOLVED: To obtain a distribution power supply system for controlling the voltage of a power distribution system at a constant level, even if a plurality of distribution power supplies are connected to the power distribution system.

SOLUTION: This distribution power supply system supplies power from a commercial power supply 1 to a load 10 that is connected to a power distribution line 8 via a power transmission line 2, a transformer 6 of a power distribution substation, a power transmission system circuit breaker 7, and the power distribution line 8 and supplies the AC power of the distribution power supply obtained from a system connection converter for converting a DC power from a DC power supply to an AC power to the power distribution line 8 via a connection reactor 12 and a power distribution system circuit breaker 11, and is provided with a control device 16 for inputting a system voltage and a system current from detectors 17 and 18, which are provided at the primary side of the connection reactor 12 and for controlling the distribution power supply. The control device 16 inputs a system voltage and a system current, at the same time inputs an output effective current command and an output reactive current command, and supplies power to the distribution power supply, while compensating for the reactive power to maintain the voltage of the power distribution line 8 at a constant level.



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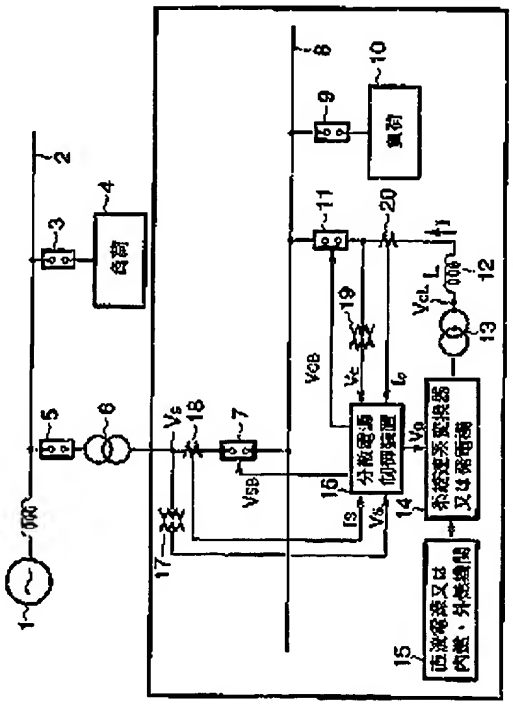
(54)【発明の名称】　分散電源システム

(57)【要約】
【課題】複数の分散電源が配電系統に連系された場合でも配電系統の電圧を一定に制御できる分散電源システムを得る。
【解決手段】商用電源１からの電力を、送電線２、配電変電所の変圧器６、送電系統遮断器７、配電線８を介して８に接続されている負荷１０に供給し、直流電源からの直流電力を交流電力に変換する系統連系変換器から得られる分散電源の交流電力を、連系リアクトル１２、配電系統遮断器１１を介して８に供給するように構成し、１２の一次側に設けた検出器１７，１８からの系統電圧及び系統電流を入力し、前記分散電源を制御する制御装置１６を備え、１６は、系統電圧及び系統電流を入力すると共に、出力有効電流指令と出力無効電流指令を入力し、８の電圧を一定に保つため、無効電力を補償しながら前記分散電源に電力を供給するようにした分散電源システム。



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【特許請求の範囲】

【請求項１】　商用電源からの電力を、送電線、配電変電所の変圧器、送電系統遮断器、配電線を介して該配電線に接続されている負荷に供給し、

直流電源からの直流電力を交流電力に変換する系統連系変換器又は内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する発電機から得られる分散電源の交流電力を、連系リアクトル、配電系統遮断器を介して前記配電線に供給するように構成し、

前記連系リアクトルの一次側に設けた系統検出器からの系統電圧検出値及び系統電流検出値を入力し、前記分散電源を制御する制御装置を備えた分散電源システムにおいて、

前記制御装置は、前記系統電圧検出値及び系統電流検出値を入力すると共に、出力有効電流指令と出力無効電流指令を入力し、

前記配電線の電圧を一定に保つため、無効電力を補償しながら前記分散電源に電力を供給するようにしたことを特徴とする分散電源システム。

【請求項２】　前記制御装置は、電流制御装置と、出力電圧指令発生装置と、制御信号発生装置と、配電系統遮断器制御装置と、送電系統遮断器制御装置とからなり、

前記電流制御装置は前記出力有効電流指令と前記出力無効電流指令と系統電圧検出値と系統電流検出値とを入力し無効電力がゼロになるような電圧指令を出力するものであり、

前記出力電圧指令発生装置は前記電圧指令を入力し前記系統連系変換器または発電機が発生可能な出力電圧指令を生成するものであり、

前記制御信号発生装置は前記出力電圧指令発生装置からの出力電圧指令を入力し出力制御信号を発生し、該出力制御信号を前記系統連系変換器または発電機に与えるするものであり、

前記送電系統遮断器制御装置は前記検出器により検出された系統電圧検出値および前記系統電流検出値を入力し、その値が指定値より小さい場合は前記分散電源の単独運転を防止するために前記送電系統遮断器に対して制御信号を出力するものであり、

前記配電系統遮断器制御装置は前記分散電源の出力電圧および前記分散電源の出力電流を入力し、その値が指定値より大きい場合、過電圧、過電流を防止するために前記配電系統遮断器に対して制御信号を出力するものである請求項１記載の分散電源システム。

【請求項３】　商用電源からの電力を、送電線、配電変電所の変圧器、送電系統遮断器、配電線を介して該配電線に接続されている負荷に供給し、

直流電源からの直流電力を交流電力に変換する系統連系変換器又は内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する発電機から得られる分散電源の交流電力を、連系リアクトル、配電系統遮断器を介して前記配電線に供給するように構成し、

前記連系リアクトルの一次側に設けた系統検出器からの系統電圧検出値及び系統電流検出値を入力し、前記分散電源を制御する制御装置を備えた分散電源システムにおいて、

前記制御装置は、前記系統電圧検出値及び系統電流検出値を入力すると共に、出力電圧指令を入力し、

前記配電線の電圧を一定に保つため、無効電力を補償しながら前記分散電源に電力を供給するようにしたことを特徴とする分散電源システム。

【請求項４】　前記制御装置は、電圧制御装置と、電流制御装置と、出力電圧指令発生装置と、制御信号発生装置と、配電系統遮断器制御装置と、送電系統遮断器制御装置とからなり、

前記電圧制御装置は前記出力電圧指令と前記系統電圧検出値を入力し、無効電力がゼロになるような電流指令を出力するものであり、

前記電流制御装置は前記電圧制御装置からの電流指令と前記系統電流検出値とを入力し電圧指令を出力するものであり、

前記出力電圧指令発生装置は前記電圧制御装置からの電圧指令を入力し前記系統連系変換器または発電機の発生可能な出力電圧指令を生成するものであり、

前記制御信号発生装置は前記出力電圧指令発生装置からの出力電圧指令を入力し出力制御信号を発生するものであり、

前記送電系統遮断器制御装置は前記検出器により検出された系統電圧検出値および前記系統電流検出値を入力し、その値が指定値より小さい場合は前記分散電源の単独運転を防止するために前記送電系統遮断器制御信号を出力するものであり、

前記配電系統遮断器制御装置は前記配電電圧および前記配電電流を入力し、その値が指定値より大きい場合、過電圧、過電流を防止するために配電系統遮断器制御信号を出力するものである請求項３記載の分散電源システム。

【請求項５】　商用電源からの電力を、送電線、配電変電所の変圧器、送電系統遮断器、配電線を介して該配電線に接続されている負荷に供給し、

直流電源からの直流電力を交流電力に変換する系統連系変換器又は内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する発電機から得られる分散電源の交流電力を、連系リアクトル、配電系統遮断器を介して前記配電線に供給するように構成し、

前記系統連系変換器又は発電機に接続した無効電力補償装置と、

前記連系リアクトルの一次側に設けた系統検出器からの系統電圧検出値及び系統電流検出値を入力し、前記分散電源を制御する制御装置を備えた分散電源システムにおいて、

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前記制御装置は前記配電線の電圧に対する位相を制御しながら前記配電線の電圧を一定に保つことを特徴とする分散電源システム。

【請求項６】　前記制御装置は、位相制御装置と、出力電圧発生装置と、制御信号発生装置と、配電系統遮断器制御装置と、送電系統遮断器制御装置からなり、

前記位相制御装置は前記商用電源の出力電圧の位相角指令と前記商用電源の系統電圧検出値を入力し電圧指令を出力するものであり、

前記出力電圧発生装置は前記電圧指令を入力し出力電圧指令を発生するものであり、

前記制御信号発生装置は前記出力電圧指令に対応した制御信号を発生するものであり、

前記送電系統遮断器制御装置は前記系統電圧検出値および前記系統電流検出値を入力し、その値が指定値より小さい場合は前記分散電源の単独運転を防止するために前記送電系統遮断器に対して制御信号を出力するものであり、

前記配電系統遮断器制御装置は前記配電電圧および前記配電電流を入力しその値が指定値より大きい場合、過電圧、過電流を防止するために配電系統遮断器に対して制御信号を出力するものである請求項５記載の分散電源システム。

【請求項７】　商用電源からの電力を、送電線、配電変電所の変圧器、送電系統遮断器、配電線を介して該配電線に接続されている複数の負荷に供給し、

複数の直流電源からの直流電力を交流電力に変換する複数の系統連系変換器又は複数の内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する複数の発電機から得られる複数の分散電源の交流電力を、複数の連系リアクトル、複数の配電系統遮断器を介して前記配電線に供給するように構成し、

前記各連系リアクトルの一次側に設けた複数の系統検出器からの系統電圧検出値及び系統電流検出値を入力し、前記複数の分散電源を制御する複数の制御装置を備えた分散電源システムにおいて、

前記各制御装置は、前記系統電圧検出値及び系統電流検出値を入力すると共に、出力有効電流指令と出力無効電流指令を入力し、

前記配電線の電圧を一定に保つため、無効電力を補償しながら前記分散電源に電力を供給するようにしたことを特徴とする分散電源システム。

【請求項８】　商用電源からの電力を、送電線、配電変電所の変圧器、送電系統遮断器、配電線を介して該配電線に接続されている負荷に供給し、

直流電源からの直流電力を交流電力に変換する系統連系変換器又は内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する発電機から得られる分散電源の交流電力を、連系リアクトル、配電系統遮断器を介して前記配電線に供給するように構成し、

前記連系リアクトルの一次側に設けた系統検出器からの系統電圧検出値及び系統電流検出値を入力し、前記分散電源を制御する制御装置を備えた分散電源システムにおいて、

前記送電系統遮断器と前記配電線の間に、リアクトルと直列補償装置の直列回路を接続し、前記制御装置は、前記系統電圧検出値及び系統電流検出値を入力すると共に、出力有効電流指令と出力無効電流指令を入力し、

前記配電線の電圧を一定に制御しながら、前記直列補償装置により前記送電線に電圧が印加され、前記リアクトルに電圧がかけられることにより、前記配電線から前記送電線に対して電力供給を行うことを特徴とする分散電源システム。

【請求項９】　商用電源からの電力を、送電線、配電変電所の変圧器、送電系統遮断器、配電線を介して該配電線に接続されている複数の負荷に供給し、

複数の直流電源からの直流電力を交流電力に変換する複数の系統連系変換器又は複数の内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する複数の発電機から得られる分散電源の交流電力を、それぞれ連系リアクトル、配電系統遮断器を介して前記配電線に供給するように構成し、

前記各連系リアクトルの一次側に設けた系統検出器からの系統電圧検出値及び系統電流検出値を入力し、前記複数の分散電源を制御する複数の制御装置を備えた分散電源システムにおいて、

前記送電系統遮断器と前記配電線の間に、リアクトルと直列補償装置の直列回路を接続し、前記各制御装置は、前記系統電圧検出値及び系統電流検出値を入力すると共に、出力有効電流指令と出力無効電流指令を入力し、

前記配電線の電圧を一定に制御しながら、前記直列補償装置により前記送電線に電圧が印加され、前記リアクトルに電圧がかけられることにより、前記配電線から前記送電線に対して電力供給を行うことを特徴とする分散電源システム。

【請求項１０】　商用電源からの電力を、送電線、配電変電所の変圧器、送電系統遮断器、配電線を介して該配電線に接続されている複数の負荷に供給し、複数の直流電源からの直流電力を交流電力に変換する複数の系統連系変換器又は複数の内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する複数の発電機から得られる分散電源の交流電力を、それぞれ連系リアクトル、配電系統遮断器を介して前記配電線に供給するように構成し、

前記各連系リアクトルの一次側に設けた系統検出器からの系統電圧検出値及び系統電流検出値を入力し、前記複数の分散電源を制御する複数の制御装置を備えた分散電源システムにおいて、

前記送電系統遮断器と前記配電線の間に、リアクトルと直列補償装置の直列回路を接続し、前記各制御装置は、

前記系統電圧検出値及び系統電流検出値を入力すると共に、出力有効電流指令と出力無効電流指令を入力し、前記１台の分散電源のみ前記制御装置により電圧制御を行い、残り他の分散電源は前記他の制御装置で電流制御を行い、前記配電線の電圧を一定に制御しながら、前記配電線から前記送電線に対して電力供給を行うことを特徴とする分散電源システム。

【請求項１１】　商用電源からの電力を、送電線、配電変電所の変圧器、送電系統遮断器、配電線を介して該配電線に接続されている複数の負荷に供給し、

複数の直流電源からの直流電力を交流電力に変換する複数の系統連系変換器又は複数の内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する複数の発電機から得られる分散電源の交流電力を、それぞれ連系リアクトル、配電系統遮断器を介して前記配電線に供給するように構成し、

前記各連系リアクトルの一次側に設けた系統検出器からの系統電圧検出値及び系統電流検出値を入力し、前記複数の分散電源を制御する複数の制御装置を備えた分散電源システムにおいて、

前記送電系統遮断器と前記配電線の間に、リアクトルと直列補償装置の直列回路を接続し、前記各制御装置は、前記系統電圧検出値及び系統電流検出値を入力すると共に、出力有効電流指令と出力無効電流指令を入力し、前記１台の分散電源のみ前記制御装置により電流制御を行い、残り他の分散電源は前記他の制御装置で電圧制御を行い、前記配電線の電圧を一定に制御しながら、前記配電線から前記送電線に対して電力供給を行うことを特徴とする分散電源システム。

【請求項１２】　第１の商用電源に接続されている第１の送電線と、第２の商用電源に接続されている第２の送電線の間に、系統間リアクトルと系統間直列補償装置の直列回路を接続し、

前記各送電線にそれぞれ配電変電所の変圧器を介して配電線を接続し、該各配電線に複数の負荷を接続すると共に、該各負荷と前記各配電線の間に、送電系統遮断器を介してリアクトルと直列補償装置からなる直列回路をそれぞれ接続し、

該各配電線に接続されている負荷に対応して設けられ、直流電源からの直流電力を交流電力に変換する系統連系変換器又は内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する発電機から得られる分散電源の交流電力を、それぞれ連系リアクトル、配電系統遮断器を介して前記各配電線に供給するように構成し、

前記連系リアクトルの一次側に設けた系統検出器からの系統電圧検出値及び系統電流検出値を入力し、前記分散電源を制御する制御装置を備え、

前記第１及び第２の送電線間での電力融通を行うようにしたことを特徴とする分散電源システム。

【請求項１３】　前記第１及び第２の送電線間に、接続される前記系統間リアクトルと前記系統間直列補償装置の直列回路に、直列に交流スイッチを接続したことを特徴とする請求項１２に記載の分散電源システム。

【請求項１４】　前記第１及び第２の送電線間に、接続される前記系統間リアクトルと前記系統間直列補償装置の直列回路に、並列に遮断器を接続したことを特徴とする請求項１２に記載の分散電源システム。

【請求項１５】　前記第１及び第２の送電線間に、接続される前記系統間リアクトルと前記系統間直列補償装置の直列回路に並列に遮断器を接続すると共に、これらに直列に交流スイッチを接続したことを特徴とする請求項１２に記載の分散電源システム。

【請求項１６】　第１の商用電源に接続されている第１の送電線と、第２の商用電源に接続されている第２の送電線の間に、系統間リアクトルと系統間直列補償装置の直列回路を接続し、

前記各送電線にそれぞれ配電変電所の変圧器を介して配電線を接続し、該各配電線に複数の負荷を接続すると共に、該各負荷と前記各配電線の間に、送電系統遮断器を介してリアクトルと直列補償装置からなる直列回路をそれぞれ接続し、

該各配電線に接続されている負荷に対応して設けられ、直流電源からの直流電力を交流電力に変換する系統連系変換器又は内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する発電機から得られる分散電源の交流電力を、それぞれ連系リアクトル、配電系統遮断器を介して前記各配電線に供給するように構成し、

前記連系リアクトルの一次側に設けた系統検出器からの系統電圧検出値及び系統電流検出値を入力し、前記分散電源を制御する制御装置を備え、

前記第１及び第２の送電線間での電力融通を行うようにしたことを特徴とする分散電源システム。

【請求項１７】　第１の商用電源に接続されている第１の送電線と、第２の商用電源に接続されている第２の送電線の間に、系統間リアクトルと系統間直列補償装置の直列回路を接続し、

前記各送電線にそれぞれ配電変電所の変圧器を介して配電線を接続し、該各配電線に複数の負荷を接続すると共に、該各負荷と前記各配電線の間に、送電系統遮断器を介してリアクトルと直列補償装置からなる直列回路をそれぞれ接続し、

該各配電線に接続されている負荷に対応して設けられ、直流電源からの直流電力を交流電力に変換する系統連系変換器又は内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する発電機から得られる分散電源の交流電力を、それぞれ連系リアクトル、配電系統遮断器を介して前記各配電線に供給するように構成し、

前記連系リアクトルの一次側に設けた系統検出器からの系統電圧検出値及び系統電流検出値を入力し、前記分散電源を制御する制御装置を備え、

前記両系統の分散電源を全て電圧制御しながら潮流制御することを特徴とする分散電源システム。

【請求項１８】　第１の商用電源に接続されている第１の送電線と、第２の商用電源に接続されている第２の送電線の間に、系統間リアクトルと系統間直列補償装置の直列回路を接続し、

前記各送電線にそれぞれ配電変電所の変圧器を介して配電線を接続し、該各配電線に複数の負荷を接続すると共に、該各負荷と前記各配電線の間に、送電系統遮断器を介してリアクトルと直列補償装置からなる直列回路をそれぞれ接続し、

該各配電線に接続されている負荷に対応して設けられ、直流電源からの直流電力を交流電力に変換する系統連系変換器又は内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する発電機から得られる分散電源の交流電力を、それぞれ連系リアクトル、配電系統遮断器を介して前記各配電線に供給するように構成し、

前記連系リアクトルの一次側に設けた系統検出器からの系統電圧検出値及び系統電流検出値を入力し、前記分散電源を制御する制御装置を備え、

前記両系統の分散電源を全て位相制御しながら潮流制御することを特徴とする分散電源システム。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は商用電源からの電力を、配電用開閉手段を介して配電系統に供給し、該配電系統に分散電源用開閉手段、連系リアクトル、変圧器を介して系統連系変換器または発電機から得られる分散電源に、該電力を供給するようにした分散電源システムに関する。

【０００２】

【従来の技術】従来の分散電源の制御装置について参考文献に基づき説明する。ここで、参考文献とは、電気学会、電力・エネルギー部門、新・省エネルギー技術委員会、電気学会技術報告・第６０９号、「都市形分散電源システム」、都市形分散電源システム、都市型分散電源システム調査委員会、１９９６年１０月のことである。図１は、参考文献（本発明の概略構成と共通）の分散電源システムの構成を示している。上位の商用系統は、商用電源１に接続された送電線２、同送電線に遮断器３と遮断器５を介して接続される大規模負荷４と配電用変電所内の変圧器６から構成される。

【０００３】配電系統は、変圧器６には遮断器７を介して、配電線８が接続されている。配電線８には、遮断器９と遮断器１１を介して中小規模の負荷１０とその地域への配電を目的とした分散電源システムから構成されている。

【０００４】分散電源システムは、連系リアクトル１２、変圧器１３、系統連系変換器または発電機１４、直流電源または内燃・外燃機関１５、及び分散電源の制御装置１６から構成される。

【０００５】図３に従来（本発明も共通）の分散電源システムにおけるベクトル図を示す。直流電源または内燃・外燃機関１５は、必要に応じて直流電力を発生または動力を発生する。系統連系変換器または発電機１４は直流電力または動力を入力し、分散電源の制御装置１６により制御され所定の交流電力を発生する。分散電源の制御装置１６は、対象地域の負荷に対し配電を行う。対象地域の負荷率が上昇した場合は、分散電源の制御装置１６は、遮断器７を閉入して商用系統から受電する。

【０００６】また分散電源の制御装置１６は、対象地域の負荷率が下がった場合にも、その余剰電力を売電するために遮断器７を閉入する。

【０００７】分散電源の制御装置１６は、遮断器７の１次側に取り付けた系統電圧検出器１７と、系統電流検出器１８、及び連系リアクトル１２の１次側に取り付けている。電圧検出器１７と電流検出器１８とにより各点の電圧と電流を検出し、分散電源の単独運転状態を判定する。分散電源が単独運転をしている場合は、遮断器７を解列し分散電源の単独運転を防止する。

【０００８】従来の分散電源には、ガスエンジンなどを用いたコージェネレーションシステム、燃料電池発電システム、太陽光発電システム、風力発電システム、及び廃棄物発電システムがあり、以下これらについて、図１９～図２５を参照して説明する。

【０００９】図１９は従来のコージェネレーションシステムを示すもので、ガスタービン発電機８０と、排ガスボイラ８１からなり、ガスタービン発電機８０は、都市ガスなどを燃料として熱（排気ガス）と電気（発電電力）を発生する。排ガスボイラ８１はガスタービン発電機８０が発生する排気ガスを回収することにより高い熱効率を得ようとする省エネルギーシステムである。

【００１０】１９９６年１０月現在で３，３００，０００ｋＷ以上が稼動している。建物用途では、宿泊施設が最も多い（全体の２１％）。また発電容量も宿泊施設が１２５ＭＷ出力（２３％）で最大である。設置件数の累計、設置台数、及び発電出力ともディーゼルエンジンがそれぞれ５４％、５７％、５５％と最大である。燃料の設置件数では、重油の割合が４５％で最大である。全国レベルでは、ディーゼルエンジンを主とする液体燃料のコージェネレーションシステムが過半数を占める。発電容量では重油の割合が５４％と最高である。

【００１１】図２０は、従来の燃料電池発電システムを示すもので、等温プロセスで燃料と酸化剤の化学エネルギーを連続して電気エネルギーに変換する。燃料電池発電システムは、基本的に燃料処理装置８２、燃料電池本体８３、直交変換装置８４から構成される。燃料としては、水素ガス、天然ガス、石炭ガス、石油、アルコール類などを使用する。燃料処理装置８２は、原燃料を水素成分の多いガスに転換する。燃料電池本体８３は、電極

における燃料と酸化剤の電気化学的変換反応により直流電力を発生する。燃料電池の主要部は、電解質と電極である。電解質は、イオンと電子を振り分ける機能を有する。内部はイオンだけが通過し、電子は阻止される。発電機能は、電極にある。燃料のもつ化学エネルギーが電極で電気エネルギーに変換される。酸化剤としては、主として空気が使用される。直交変換装置８４は、その直流電力を交流電力に変換する。

【００１２】燃料電池の耐電力網の特徴としては、直接発電のため、従来の発電所よりも簡単に構成できる。また回転子が無く、慣性が比較的小さくなり、電気的な負荷変動に速やかに追従できるため、電力回路の安定度あるいは信頼性の向上に有効である。更に高い出力電圧を得るために素子を電気的に直列接続するので、任意の出力電圧が得られ、電圧階級の任意性とともに、小出力から大出力まで広い範囲に渡る各種のスケールの発電システムが可能である。

【００１３】燃料電池の耐環境性の特徴としては、機械的部分が少ないことによる騒音が比較的小さいこと、本体に燃焼器部分がなく、燃料処理装置で炭化水素ガスを水素成分の多いガスに転換するために、本体部分でのＮＯｘ、ＣＯの発生が少ない。

【００１４】また未燃ガスは、回収されて再使用されるので、その存在は大きな問題とはならない。硫黄分については、燃料ガスの段階で除去するので、燃料電池からの排出は極めて少ない。さらに、発電効率が高く、部分負荷特性が良いため、同規模の内外燃機関発電に比較するとCO_2の放出量が少ない。

【００１５】燃料電池の効率の特徴としては、この電気化学的反応は、等温反応であるとともに、燃料のもつ自由エネルギーを直接電気エネルギーに変換するので、カルノーサイクルに支配されず高い発電効率を期待できる。

【００１６】また、部分負荷効率が定格運転のときと同様に高く維持できる。従来の分散電源システムは、対象地域への配電を行うことを目的としている。必要時は商用系統に連携することにより受電（買電）または売電を行う。

【００１７】民生用燃料電池として開発が最も進展し、商用化の段階にあるものとして、リン酸形燃料電池がある。この燃料電池は、数１０ｋＷの大きさのものから１０数ＭＷ規模のものまで製作されている。直交変換器は、インバータ、出力変圧器、交流フィルタなどから構成される。インバータの主回路としては、ＩＧＢＴ素子などが採用されている。

【００１８】制御としては自励式電圧形ＰＷＭ方式の事例がある。系統動揺時にも、安定な運転が継続できるように電流制御機能を付加し、高効率かつ高制御な変換器を完成している。高調波を抑制するために４ブリッジ２４相多重方式が利用されている。

【００１９】更に、系統連系ガイドラインに基づく逆潮流連系時に必要とされる単独運転検出機能がインバータ制御に組み込まれている。運転モードとしては系統連系および自立運転に対応する。また待機モードにより、外部配電系統の停電時などには、独立して待機モードへ移行することとし、停電復旧後の速やかな電力供給開始に対応でき、電池寿命に影響を及ぼす起動・停止をできるだけ回避している。さらに、電力の利用は、その地域が主であるが、余剰分は系統へ逆潮流したり受電電力制御を行っている。運転形態としては一定出力運転や出力制御運転を行っている。

【００２０】図２１と図２２は従来の太陽光発電システムを示すものであり、このシステムは太陽光を利用することにより、商用電力系統のピークカットにも貢献すると期待されており、太陽電池アレイ８５、蓄電池８６、インバータ８７からなるもの、又は太陽電池アレイ８５、インバータ８７、保護装置８８、電力量計８９、商用系統９０からなるものいる新エネルギーシステムである。

【００２１】国としても導入支援・規制の合理化・技術開発・標準化などの導入促進を示す「新エネルギー大綱」を策定し、その導入の促進を図っている。

【００２２】このシステムは、エネルギーの安定供給・地球環境保全・省エネルギーに特徴を持つ。特徴的な性能として、(1) 発電効率が規模の大小によらずほぼ一定、(2) 発電システムの自由度が大きい、(3)発電容量（受光面積）の選択範囲が広い、(4)直流電源として使用できるなどがある。

【００２３】信頼性においては、(1) 完全な静止器であるので信頼性が高い、(2) 非常時に確実に動作するので信頼性が高い、(3) 他の発電のバックアップになるなどの長所がある。

【００２４】経済性は、(1) エネルギー源は太陽であるので無尽蔵で無料である、(2) 太陽光は放棄エネルギーの有効利用である、(3) 量産性に富む、(4)スケールメリットが期待できる、(5) 燃料・潤滑油・冷却水などの運転費が不要である、(6) 省エネルギーである、(7) エネルギー回収時間が短い、(8) エネルギー源の輸送費が不要であることなどが挙げられる。

【００２５】また、操作性における長所としては、(1) 太陽光は地球上のほとんどの場所で利用できる、(2) 運転・保守・点検が簡素である、(3) 自動化・無人化が容易である、(4) 消費地で発電できる、(5) 非常時にも消防電源・燃料・冷却水などのユーティリティを必要としない、(6) 離島・山岳地帯・砂漠・草原・未開発地域など送電未設備地域の独立電源として有効・環境性、(7) 太陽光はクリーンであるので無公害なエネルギー源である、(8)排気、排熱などの環境汚染の心配がないので無公害システムである、(9)回転機のように可動部分がないので、騒音・振動・摩擦などの問題がないほどがあ

る。

【００２６】短所については以下の通りである。性能においては、(1) エネルギー密度が小さいので設置スペースが大きい、(2) 発電出力が気象条件（天候）に左右される．(3) 夜間は発電できないなどの短所がある。経済性の短所では．装置のコストが高い点である。

【００２７】操作性の短所としては．(1) 交流電源が必要な場合は、インバータ１による直流・交流変換が必要である、(2) 悪天候・夜間に発電出力が低い場合に、安定な電源を得るためには．蓄電池が必要である．(3) 蓄電池を設ける場合、設置スペースの確保・保守・点検が必要であることが挙げられる。

【００２８】太陽電池は．半導体の量子光電効果を用い．光エネルギーを直接電気エネルギーに変換する。太陽電池は、半導体のｐ－ｎ接合で構成される。これに光が照射されると．電子・正孔が発生する。これがキャリアとなる。ｐ－ｎ接合部の電界により電子はｎ形．正孔はｐ形に引き寄せられる。その結果．ｎ形は負に．ｐ形は正に帯電する。従ってｐ形、ｎ形間に負荷を接続すると．電流が流れ電力を取り出せる。出力最大電力は、光の強さにほぼ比例して変化する。

【００２９】効率・信頼性・コストの面をすべて満足する太陽電池は．シリコンの結晶系（単結晶、多結晶、多結晶薄膜、その他）である。従来の独立システムは、商用電力とは独立である。太陽光発電の電力だけで負荷の消費電力をまかなう。(1)山間僻地、(2)発展途上国．(3) 携帯・移動用発電システム、(4) 太陽電池・蓄電池・負荷の一体システムなどで利用される。太陽電池をセルと呼び、セルをパネル化したものをモジュールという。モジュールが実用単位である。モジュールを必要枚数ならべたものをアレイという。

【００３０】従来の系統連系システムは、太陽電池で発電した電力を優先的に利用し、不足電力を商用電源から補う。太陽電池の出力が足りない場合には、電力系統に切り替える。（逆潮流無しのシステム）電力系統と常時接続し、太陽電池で発電した電力が消費電力を上回る場合には、余剰電力を逆潮流させ売電する。（逆潮流有りのシステム）電力系統と接続する際の保護と安全確認のための連系保護装置が付加される。インバータは太陽電池や電力系統の異常を検知しシステム停止の機能を有する。単独運転検出機能として第三次高調波電圧ひずみ急増検出方式、周波数シフト方式がある。

【００３１】長所は、経済性においては、(1) 電力を貯える必要が無い．(2) 高価な蓄電池が不要、(3) 余剰電力を電力会社へ売電できる．(5) 昼間は地域内の負荷に電力を供給する．(6) 夜間は電力会社の電力により負荷に給電するなどの長所がある。また有効性においては、(1) 夏場のピークカットに有効である．(2) 需要家は日射量の変化と天候に依存せず電力供給が受けられるなどの長所がある。

【００３２】図２３と図２４は、従来の風力発電システムを示すものであり、風力発電システムは、駆動源となるロータを有する風力発電機９１と．コントローラ９２．蓄電池９３．インバータ９４からなる発電システムから構成される。ロータとしてはプロペラ形が大勢を示している。発電機では、同期機、誘導機、可変速システムがある。

【００３３】長所は、まず性能面では．プロペラ形の特徴は回転ごとのトルク変動が少なく．自己駆動力を有しピッチ制御によりある程度回転数調整と、出力調整が可能であることである。また環境面では．クリーンで無尽蔵である点が特徴である。

【００３４】短所は、性能面では、(1) 時間的または地域的に既存量が変化する．(2) 空気密度が低い．(3)出力容量の割にシステムの物量が大きい点が上げられる。

【００３５】また経済性においては．(1) プロペラ形では．タワーを必要とする．(2) 誘導機は、連系運転のための高度な制御が不要であり、コストも安く、信頼性も高い．(3) 可変速システムは高価であるなどの特徴がある。制御性では(1) プロペラ形では．方位制御が必要である．(2)同期機は同期をとるための回転数調整が困難であるので実用化の可能性が無い。更に環境面では騒音・景観・安全性の面に課題がある。

【００３６】図２５は、従来の廃棄物発電システムを示すものであり．廃棄物発電システムは．ごみ問題に対してエネルギー面からサポートする点で期待されている。このシステムは．ごみ焼却装置９８→熱回収装置９９→熱供給装置１００→熱供給装置１０１→発電装置１０２からなっている。回収エネルギーのほとんどが貯蔵・運搬のできない瞬時形のシステムである。特徴としては、まず性能面では．(1)出力が大きい、(2) 安定した電源である。また効果においては、(1) ごみの資源化を推進する．(2) ごみの再利用を推進する．(3) 多量の余剰電力を発生する点が上げられる。

【００３７】従来の分散電源発電システムの逆潮流運転時の電圧制御と無効電力制御においては、受電時は受電力率１．０とするために．受電無効電力１０とする発電機無効電力制御を行っていた。

【００３８】一方、逆送電時は、配電系統の電圧を一定に維持するために、受電点力率一定制御を行う。分散形電源の発電機が商用系統と連系運転中において．商用系統側へ電力を出している場合は、商用系統側の電圧が上昇する方向となる。商用系統側の電圧が上昇しすぎると．同一系統内に接続されている負荷に対して不具合が発生することになる。

【００３９】従って、電圧上昇を極力抑えながら電力を商用系統側へ出す必要がある。連系点の電圧上昇は、概略次式で表現される。

【００４０】

$$\Delta V1 \doteq (R \cdot P + X \cdot Q) / V_S \qquad (1)$$

ここで、Ｐ＝分散電源発電システムから系統に送り込まれる有効電力.
Ｑ＝分散電源発電システムから系統に送り込まれる無効電力.
Ｖｓ＝系統電圧.
Ｒ＝連系線の抵抗、
Ｘ＝連系線のリアクタンス
従って、連系点の電圧上昇値を零にするためには.
Ｒ・Ｐ＋Ｘ・Ｑ＝０　　（２）
となるように有効電力Ｐに対して無効電力Ｑを制御すればよい。

【００４１】即ち、次式にて示される様に、商用系統側に送り出す電力に比例して無効電力を系統側から受け入れればよい。

【００４２】Ｑ＝－（Ｒ／Ｘ）Ｐ　　（３）
つまり、商用系統へ送り出す電力に比例して無効電力を系統側より受け入れればよいことになる。この場合、分散電源の発電機としては、進相運転領域の方向となるので、発電機の進相運転限界と構内系統に接続されている進相用コンデンサの制御に注意を要する。

【００４３】
【発明が解決しようとする課題】コージェネレーションシステムの課題としては、燃料や騒音問題などである。燃料電池の課題は、信頼性の面においては、プラントのトラブルにおいて電気・制御の特にインバータ関係のトラブルが多い事例が報告されている。そのため信頼性、高効率化、耐久性、価格面に更なる改善が必要とされている。

【００４４】太陽光発電の短所としては、性能においては、(1) エネルギー密度が小さいので設置スペースが大きい、(2) 発電出力が気象条件（天候）に左右される、(3)夜間は発電できないなどの短所がある。経済性の短所は装置のコストが高い点である。

【００４５】操作性の短所は、(1) 交流電源が必要な場合はインバータによる直流・交流変換が必要である、(2) 悪天候・夜間に発電出力が低い場合に安定な電源を得るためには蓄電池が必要である、(3) 蓄電池を設ける場合設置スペースの確保・保守・点検が必要であることが挙げられる。

【００４６】太陽光発電は、自然エネルギーを利用する点で環境性がよい。しかしエネルギーの発生が不安定であり、規模の点においても問題が多い。今後の課題としては、高性能・低コストを目指す太陽電池の製造技術開発の面においては、(1) 薄形多結晶太陽電池製造技術の実用化研究、(2)薄膜太陽電池製造技術の実用化研究、(3)超効率太陽電池の実用化研究を進める必要がある。

【００４７】また、太陽電池をうまく使いこなすシステム技術開発の面では、(1) 系統連系に関するプラント研究、(2) 独立分散の各種システム技術に関するプラント研究、(3)電力供給システムに関するプラント研究、(4) 要素技術の改良研究、(5)システム評価研究を行うことが必要である。

【００４８】更に、周辺技術開発における課題としては、(1) 系統連系住宅用高効率コンバクトインバータ（トランスレス）、(2) 系統連系制御技術の評価、(3) 新形蓄電池、(4) 建材一体形モジュール、(5) ＰＶアレイの多種設置方法などがある。

【００４９】その他の課題としては、太陽光発電システムの実証試験、国際共同研究実証、フィージビリティスタディ、気象調査、ＩＥＡ太陽光発電システム研究協力などがある。

【００５０】風力発電機の課題は、構成においては、(1)軽量化、(2) スリム化、(3) 簡素化の課題がある。また適用地域性については、賦存量の少ない地域での実用化である。更に環境においては騒音・景観に課題がある。保守性については、運用費の低減の課題がある。

【００５１】発電制御システムでは、性能面では、(1) 運転可能風速範囲の拡大、(2) 風向・風速変動への対応可能性の向上、(3) 弱小系統との連系可能性の向上、(4)低出力時の電力の品質の向上、(5)大容量システムを可能とする電力変換、制御システムの開発の課題がある。

【００５２】風力発電は、自然エネルギーを利用する点で太陽光発電と同様に、環境性がよい。しかしやはりエネルギーの発生が不安定であり、規模の点や騒音などの点においても問題が多い。

【００５３】廃棄物発電システムの課題としては、(1) 効率の最大化、(2) 行政的課題（立地の制約、環境問題、法規制、技術面）、(3)経済などの項目がある。

【００５４】このような各種の分散電源からなる複数の分散電源を有する配電系統には以下のような問題がある。

【００５５】第１に、コンデンサの切り換え動作の低速性により、負荷の急変時においては配電系統の電圧安定性に課題があり、系統電圧を所要の精度に抑制することが困難であった。

【００５６】第２に、複数の分散電源が同一配電系統に設置された場合に、その協調制御が困難であった。

【００５７】第３に、従来の分散電源の制御装置は、負荷の個数が増加した場合に全負荷に電力を同時に供給することが困難であった。

【００５８】第４に、送電系統が所要の電力を必要とする場合に配電系統全体として同容量を容易に供給するように制御することが困難であった。

【００５９】第５に、電力融通については、従来の変電所を介して交流送電を行っていたためにその効率に問題があった。

【００６０】第６に、変電所において複数の系統を連系する場合は低速の遮断器を投入することが必要であり、その耐久性、信頼性、性能において課題があった。

【００６１】第７に、連系時に高調波を抑制することが困難であった。

【００６２】本発明の目的は、複数の分散電源が配電系統に連系された場合でも配電系統の電圧を一定に制御し、負荷が増大した場合でも全体を停止することなしに運転を継続し、必要時には他の送電系統に高速に連系し複数の分散電源の協調制御するとともに所要の電力を送電系統に確実かつ効率的に送電し、複数の送電系統間でも電力融通制御を行うことができる分散電源システムを提供することである。

【００６３】

【課題を解決するための手段】前記目的を達成するため、請求項１に対応する発明は、商用電源からの電力を、送電線、配電変電所の変圧器、送電系統遮断器、配電線を介して該配電線に接続されている負荷に供給し、直流電源からの直流電力を交流電力に変換する系統連系変換器又は内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する発電機から得られる分散電源の交流電力を、連系リアクトル、配電系統遮断器を介して前記配電線に供給するように構成し、前記連系リアクトルの一次側に設けた系統検出器からの系統電圧検出値及び系統電流検出値を入力し、前記分散電源を制御する制御装置を備えた分散電源システムにおいて、前記制御装置は、前記系統電圧検出値及び系統電流検出値を入力すると共に、出力有効電流指令と出力無効電流指令を入力し、前記配電線の電圧を一定に保つため、無効電力を補償しながら前記分散電源に電力を供給するようにした分散電源システムである。

【００６４】前記目的を達成するため、請求項２に対応する発明は、請求項１記載の制御装置として、電流制御装置と、出力電圧指令発生装置と、制御信号発生装置と、配電系統遮断器制御装置と、送電系統遮断器制御装置とからなり、前記電流制御装置は前記出力有効電流指令と前記出力無効電流指令と系統電圧検出値と系統電流検出値とを入力し無効電力がゼロになるような電圧指令を出力するものであり、前記出力電圧指令発生装置は前記電圧指令を入力し前記系統連系変換器または発電機が発生可能な出力電圧指令を生成するものであり、前記制御信号発生装置は前記出力電圧指令発生装置からの出力電圧指令を入力し出力制御信号を発生し、該出力制御信号を前記系統連系変換器または発電機に与えるするものであり、前記送電系統遮断器制御装置は前記検出器により検出された系統電圧検出値および前記系統電流検出値を入力し、その値が指定値より小さい場合は前記分散電源の単独運転を防止するために前記送電系統遮断器に対して制御信号を出力するものであり、前記配電系統遮断器制御装置は前記分散電源の出力電圧および前記分散電源の出力電流を入力し、その値が指定値より大きい場合、過電圧、過電流を防止するために前記配電系統遮断器に対して制御信号を出力するものである分散電源システムである。

【００６５】前記目的を達成するため、請求項３に対応する発明は、前述の分散電源システムにおいて、前記制御装置は、前記系統電圧検出値及び系統電流検出値を入力すると共に、出力電圧指令を入力し、前記配電線の電圧を一定に保つため、無効電力を補償しながら前記分散電源に電力を供給するようにした分散電源システムである。

【００６６】前記目的を達成するため、請求項４に対応する発明は、請求項３記載の制御装置として、電圧制御装置と、電流制御装置と、出力電圧指令発生装置と、制御信号発生装置と、配電系統遮断器制御装置と、送電系統遮断器制御装置とからなり、前記電圧制御装置は前記出力電圧指令と前記系統電圧検出値を入力し、無効電力がゼロになるような電流指令を出力するものであり、前記電流制御装置は前記電圧制御装置からの電流指令と前記系統電流検出値とを入力し電圧指令を出力するものであり、前記出力電圧指令発生装置は前記電圧制御装置からの電圧指令を入力し前記系統連系変換器または発電機の発生可能な出力電圧指令を生成するものであり、前記制御信号発生装置は前記出力電圧指令発生装置からの出力電圧指令を入力し出力制御信号を発生するものであり、前記送電系統遮断器制御装置は前記検出器により検出された系統電圧検出値および前記系統電流検出値を入力し、その値が指定値より小さい場合は前記分散電源の単独運転を防止するために前記送電系統遮断器制御信号を出力するものであり、前記配電系統遮断器制御装置は前記配電線の電圧および前記配電線の電流を入力し、その値が指定値より大きい場合、過電圧、過電流を防止するために配電系統遮断器制御信号を出力するものである分散電源システムである。

【００６７】請求項１～請求項４のいずれかに対応する発明によると、負荷の急変時にも高速に配電系統の電圧を所要の精度に制御し節電するとともに系統との間において余剰・不足電力の売電を行うことができる。

【００６８】前記目的を達成するため、請求項５に対応する発明は、前述の分散電源システムにおいて、前記制御装置は前記配電線の電圧に対する位相を制御しながら前記配電線の電圧を一定に保つ分散電源システムである。

【００６９】前記目的を達成するため、請求項６に対応する発明は、請求項５記載の制御装置として、位相制御装置と、出力電圧発生装置と、制御信号発生装置と、配電系統遮断器制御装置と、送電系統遮断器制御装置からなり、前記位相制御装置は前記商用電源の出力電圧の位相角指令と前記商用電源の系統電圧検出値を入力し電圧指令を出力するものであり、前記出力電圧発生装置は前記電圧指令を入力し出力電圧指令を発生するものであり、前記制御信号発生装置は前記出力電圧指令に対応した制御信号を発生するものであり、前記送電系統遮断器

制御装置は前記系統電圧検出値および前記系統電流検出値を入力し、その値が指定値より小さい場合は前記分散電源の単独運転を防止するために前記送電系統遮断器に対して制御信号を出力するものであり．前記配電系統遮断器制御装置は前記配電電圧および前記配電電流を入力しその値が指定値より大きい場合、過電圧、過電流を防止するために配電系統遮断器に対して制御信号を出力するものである分散電源システムである。

【００７６】請求項５又は請求項６に対応する発明によれば．無効電力補償装置により配電系統の電圧を一定に制御しながら系統電圧に対する位相制御により容易に系統との間で電力の売買電を行うことができる。

【００７１】前記目的を達成するため．請求項７に対応する発明は、前述の分散電源システムにおいて．前記各制御装置は、前記系統電圧検出値及び系統電流検出値を入力すると共に．出力有効電流指令と出力無効電流指令を入力し、前記配電線の電圧を一定に保つため．無効電力を補償しながら前記分散電源に電力を供給するようにした分散電源システムである。

【００７２】請求項７に対応する発明によれば．配電系統に接続された複数の分散電源が配電系統の電圧を一定に制御することができる。これにより配電系統の電圧の安定性を高め信頼性を向上することができる。

【００７３】前記目的を達成するため．請求項８に対応する発明は、前述の分散電源システムにおいて．前記送電系統遮断器と前記配電線の間に、リアクトルと直列補償装置の直列回路を接続し．前記制御装置は、前記系統電圧検出値及び系統電流検出値を入力すると共に．出力有効電流指令と出力無効電流指令を入力し、前記配電線の電圧を一定に制御しながら、前記直列補償装置により前記送電線に電圧が印加され、前記リアクトルに電圧がかけられることにより、前記配電線から前記送電線に対して電力供給を行う分散電源システムである。

【００７４】請求項８に対応する発明によれば．分散電源の制御装置は配電系統の電圧を一定に維持しながら直列補償装置により送電電力量を制御することにより効率的な売買電を実現できる。

【００７５】前記目的を達成するため．請求項９に対応する発明は、前述の複数の分散電源を制御する複数の制御装置を備えた分散電源システムにおいて、前記送電系統遮断器と前記配電線の間に、リアクトルと直列補償装置の直列回路を接続し、前記各制御装置は、前記系統電圧検出値及び系統電流検出値を入力すると共に．出力有効電流指令と出力無効電流指令を入力し、前記配電線の電圧を一定に制御しながら．前記直列補償装置により前記送電線に電圧が印加され．前記リアクトルに電圧がかけられることにより、前記配電線から前記送電線に対して電力供給を行う分散電源システムである。

【００７６】請求項９に対応する発明によれば．複数の分散電源システムの制御装置は、配電系統の電圧を一定に維持しながら．直列補償装置により送電電力量を制御することにより効率的な売買電を実現することができる。

【００７７】前記目的を達成するため．請求項１０に対応する発明は．前述の複数の分散電源を制御する複数の制御装置を備えた分散電源システムにおいて、前記送電系統遮断器と前記配電線の間に、リアクトルと直列補償装置の直列回路を接続し．前記各制御装置は、前記系統電圧検出値及び系統電流検出値を入力すると共に．出力有効電流指令と出力無効電流指令を入力し、前記１台の分散電源のみ前記制御装置により電圧制御を行い．残り他の分散電源は前記他の制御装置で電流制御を行い、前記配電線の電圧を一定に制御しながら．前記配電線から前記送電線に対して電力供給を行う分散電源システムである。

【００７８】請求項１０に対応する発明によれば．１台の分散電源の制御装置により配電系統の電圧を一定に制御しながら、他の分散電源の制御装置は電流制御を行い．所定の電力を送電し．直列補償装置により全体の送電電力量を制御することができる。

【００７９】前記目的を達成するため．請求項１１に対応する発明は．前述の複数の分散電源を制御する複数の制御装置を備えた分散電源システムにおいて、前記送電系統遮断器と前記配電線の間に、リアクトルと直列補償装置の直列回路を接続し．前記各制御装置は、前記系統電圧検出値及び系統電流検出値を入力すると共に．出力有効電流指令と出力無効電流指令を入力し、前記１台の分散電源のみ前記制御装置により電流制御を行い．残り他の分散電源は前記他の制御装置で電圧制御を行い、前記配電線の電圧を一定に制御しながら．前記配電線から前記送電線に対して電力供給を行う分散電源システムである。

【００８０】請求項１１に対応する発明によれば．１台の分散電源のみが電流制御を行い、他の分散電源は電圧制御を行うことにより、配電系統の電圧を一定に制御しながら直列補償装置により送電電力を制御しながら送電系統との間で売買電を行うことができる。

【００８１】前記目的を達成するため．請求項１２に対応する発明は．第１の商用電源に接続されている第１の送電線と、第２の商用電源に接続されている第２の送電線の間に、系統間リアクトルと系統間直列補償装置の直列回路を接続し．前記各送電線にそれぞれ配電変電所の変圧器を介して配電線を接続し、該各配電線に複数の負荷を接続すると共に、該各負荷と前記各配電線の間に、送電系統遮断器を介してリアクトルと直列補償装置からなる直列回路をそれぞれ接続し、該各配電線に接続されている負荷に対応して設けられ、直流電源からの直流電力を交流電力に変換する系統連系変換器又は内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する発電機から得られる分散電源の交流電力を、それぞれ連

系リアクトル．配電系統遮断器を介して前記各配電線に供給するように構成し、前記連系リアクトルの一次側に設けた系統検出器からの系統電圧検出値及び系統電流検出値を入力し．前記分散電源を制御する制御装置を備え．前記第１及び第２の送電線間での電力融通を行うようにした分散電源システムである。

【００８２】請求項１２に対応する発明によれば．直列補償装置を有する複数の分散電源システムからなる複数の配電系統間を直列補償装置により接続することにより．複数の配電系統間での柔軟な電力融通を行うことができる。

【００８３】前記目的を達成するため．請求項１３に対応する発明は．請求項１２に記載の第１及び第２の送電線間に、接続される前記系統間リアクトルと前記系統間直列補償装置の直列回路に．直列に交流スイッチを接続した分散電源システムである。

【００８４】請求項１３に対応する発明によれば．直列補償装置を有する複数の分散電源システムからなる複数の配電系統間を交流スイッチと直列補償装置により接続することにより．必要に応じて複数の配電系統間での柔軟な電力融通を行うことができる。

【００８５】前記目的を達成するため．請求項１４に対応する発明は．請求項１２に記載の第１及び第２の送電線間に、接続される前記系統間リアクトルと前記系統間直列補償装置の直列回路に．並列に遮断器を接続した分散電源システムである。

【００８６】請求項１４に対応する発明によれば．直列補償装置を有する複数の分散電源システムからなる複数の配電系統間を直列補償装置とそれに並列に接続された遮断器により接続することにより、直列補償装置が故障した場合でも遮断器を閉入することにより確実に複数の配電系統間での柔軟な電力融通を行うことができる。

【００８７】前記目的を達成するため．請求項１５に対応する発明は．請求項１２に記載の第１及び第２の送電線間に、接続される前記系統間リアクトルと前記系統間直列補償装置の直列回路に並列に遮断器を接続すると共に．これらに直列に交流スイッチを接続した分散電源システムである。

【００８８】請求項１５に対応する発明によれば．直列補償装置を有する複数の分散電源システムからなる複数の配電系統間を直列補償装置とそれに並列に接続された遮断器と交流スイッチにより接続することにより．必要に応じて複数の配電系統間を連系し直列補償装置により柔軟な電力融通を行い、直列補償装置が故障した場合でも遮断器を閉入することにより確実に複数の配電系統間での柔軟な電力融通を行うことができる。

【００８９】前記目的を達成するため．請求項１６に対応する発明は．第１の商用電源に接続されている第１の送電線と、第２の商用電源に接続されている第２の送電線の間に、系統間リアクトルと系統間直列補償装置の直列回路を接続し．前記各送電線にそれぞれ配電変電所の変圧器を介して配電線を接続し、該各配電線に複数の負荷を接続すると共に、該各負荷と前記各配電線の間に、送電系統遮断器を介してリアクトルと直列補償装置からなる直列回路をそれぞれ接続し、該各配電線に接続されている負荷に対応して設けられ、直流電源からの直流電力を交流電力に変換する系統連系変換器又は内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する発電機から得られる分散電源の交流電力を、それぞれ連系リアクトル．配電系統遮断器を介して前記各配電線に供給するように構成し、前記連系リアクトルの一次側に設けた系統検出器からの系統電圧検出値及び系統電流検出値を入力し．前記分散電源を制御する制御装置を備え．前記第１及び第２の送電線間での電力融通を行うようにした分散電源システムである。

【００９０】請求項１６に対応する発明によれば．直列補償装置を有する複数の分散電源システムからなる複数の配電系統間をアクティブフィルタを有する配電線で接続することにより、高調波を抑制しながら、複数の配電系統間で柔軟な電力融通を行うことができる。

【００９１】前記目的を達成するため．請求項１７に対応する発明は．第１の商用電源に接続されている第１の送電線と、第２の商用電源に接続されている第２の送電線の間に、系統間リアクトルと系統間直列補償装置の直列回路を接続し．前記各送電線にそれぞれ配電変電所の変圧器を介して配電線を接続し、該各配電線に複数の負荷を接続すると共に、該各負荷と前記各配電線の間に、送電系統遮断器を介してリアクトルと直列補償装置からなる直列回路をそれぞれ接続し、該各配電線に接続されている負荷に対応して設けられ、直流電源からの直流電力を交流電力に変換する系統連系変換器又は内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する発電機から得られる分散電源の交流電力を、それぞれ連系リアクトル．配電系統遮断器を介して前記各配電線に供給するように構成し、前記連系リアクトルの一次側に設けた系統検出器からの系統電圧検出値及び系統電流検出値を入力し．前記分散電源を制御する制御装置を備え．前記両系統の分散電源を全て電圧制御しながら潮流制御する分散電源システムである。

【００９２】請求項１７に対応する発明によれば．直列補償装置を有する複数の分散電源システムからなる複数の配電系統間を直列補償装置で接続し．各配電系統の全分散電源により電圧制御を行うことにより各配電系統の電圧を一定に維持しながら複数の配電系統間で柔軟な電力融通を行うことができる。

【００９３】前記目的を達成するため．請求項１８に対応する発明は．第１の商用電源に接続されている第１の送電線と、第２の商用電源に接続されている第２の送電線の間に、系統間リアクトルと系統間直列補償装置の直列回路を接続し．前記各送電線にそれぞれ配電変電所の

変圧器を介して配電線を接続し、該各配電線に複数の負荷を接続すると共に、該各負荷と前記各配電線の間に、送電系統遮断器を介してリアクトルと直列補償装置からなる直列回路をそれぞれ接続し、該各配電線に接続されている負荷に対応して設けられ、直流電源からの直流電力を交流電力に変換する系統連系変換器又は内燃・外燃機関からの回転エネルギーに基づき交流電力を発電する発電機から得られる分散電源の交流電力を、それぞれ連系リアクトル、配電系統遮断器を介して前記各配電線に供給するように構成し、前記連系リアクトルの一次側に設けた系統検出器からの系統電圧検出値及び系統電流検出値を入力し、前記分散電源を制御する制御装置を備え、前記両系統の分散電源を全て位相制御しながら潮流制御する分散電源システムである。

【００９４】請求項１８に対応する発明によれば、直列補償装置を有する複数の分散電源システムからなる複数の配電系統間を直列補償装置で接続し、各配電系統の全分散電源により位相制御を行うことにより制御系の構成を容易にして複数の配電系統間で柔軟な電力融通を行うことができる。

【００９５】

【発明の実施の形態】＜第１の実施形態（請求項１，２に対応）＞第１の実施形態について図１、図２、図３を参照して説明する。図１は、第１の実施形態の全体の概略構成を示すブロック図である。すなわち、商用電源１と遮断器３を介して接続される大規模負荷４とを有する送電線２に、遮断器５を介して接続される配電用変電所の変圧器６に送電系統遮断器７を介して接続された配電線８に遮断器９を介して接続された負荷１０と、配電線８に配電系統遮断器１１を介して接続された連系リアクトル１２と、変圧器１３と系統連系変換器または発電機１４と、直流電源または内燃・外燃機関１５と遮断器７の１次側に取り付けた系統電圧検出器１７と、系統電流検出器１８と、連系リアクトル１２の１次側に取り付けている電圧検出器１９と、電流検出器２０とにより各点の電圧と電流を検出する分散電源の制御装置１６を備えている点は、従来の分散電源システムと同一である。

【００９６】分散電源の制御装置１６は、系統電圧（検出値）Ｖｓ、すなわち配電変電所の変圧器６の２次側の電圧を計測する電圧検出器１７と、系統電流（検出値）ｉｓを検出する電流検出器１８とにより、系統電圧Ｖｓと系統電流ｉｓを入力し、また連系リアクトル１２の１次側の電圧検出器１９と電流検出器２０からは出力電圧と出力電流を入力する。

【００９７】図２は、本実施形態における分散電源の制御装置１６の具体的構成を説明するためのブロック図である。電流制御装置２１は、有効電流指令ｉｄｒｅｆ、無効電流指令Ｉｑｒｅｆ、系統電圧（検出値）Ｖｓ、系統電流（検出値）ｉｓを入力し、電圧指令Ｖｒｅｆを出力電圧指令発生装置２２に出力する。

【００９８】出力電圧指令発生装置２２は、電流制御装置２１からの電圧指令Ｖｒｅｆを入力し、送電系統（送電線）２、配電系統（配電線）８がともに正常である場合は、出力電圧指令発生装置２２は、必要な電圧指令Ｖｏｕｔを制御信号発生装置２３へ出力する。

【００９９】制御信号発生装置２３は、出力電圧指令発生装置２２からの電圧指令Ｖｏｕｔを入力し、制御信号Ｖｇを系統連系変換器または発電機１４に出力する。この系統連系変換器または発電機１４は、制御信号Ｖｇを入力し、図３に示す出力電圧Ｖｃを発生する。

【０１００】送電系統遮断器制御装置２４は、系統電圧Ｖｓ、系統電流Ｉｓを入力し、系統電圧Ｖｓ又は系統電流Ｉｓがゼロである場合は、単独運転防止のために系統遮断器解列指令ＶＳＢを出力し遮断器７を解列する。

【０１０１】また配電系統遮断器制御装置２５は、分散電源出力電圧Ｖｃと分散電源出力電流Ｉｃを入力し、過電圧または過電流である場合は、配電系統遮断器１１を解列する。

【０１０２】これにより連系リアクトル１２に図３に示す電圧ベクトルΔＶが印加される。この電圧ベクトルΔＶにより連系リアクトル１２に示す有効電流①ｓｓが流れる。その結果、分散電源から配電線８と送電線６に対して電力が送電される。

【０１０３】以上述べた第１の実施形態によれば、負荷１０の急変時にも高速に配電線８の電圧を所要の精度に制御し節電するとともに系統との間において余剰・不足電力の売電を行うことができる。

【０１０４】＜第２の実施形態（請求項３，４に対応）＞第２の実施形態について、図４を参照して説明する。図４は、第１の実施形態の図１における分散電源の制御装置１６のみを示すブロック図である。

【０１０５】すなわち、出力電圧指令Ｖｃｒｅｆと系統電圧（検出値）Ｖｓを入力し、無効電力がゼロになるような電流指令Ｉｒｅｆを出力する電圧制御装置４１と、電流指令Ｉｒｅｆと系統電流（検出値）ｉｓを入力し電圧指令Ｖｒｅｆを出力する電流制御装置４２と、電圧指令Ｖｒｅｆを入力し発生可能な出力電圧指令Ｖｏｕｔを生成する出力電圧指令発生装置４３と、出力電圧指令Ｖｏｕｔを入力し出力制御信号Ｖｇを発生する制御信号発生装置４４とからなる。

【０１０６】送電系統遮断器制御装置４５は系統電圧Ｖｓと系統電流Ｉｓを入力し、系統電圧Ｖｓまたは系統電流Ｉｓがゼロである場合は、単独運転防止のために系統遮断器解列指令ＶＳＢを出力し遮断器７を解列する。

【０１０７】また、配電系統遮断器制御装置４６は、分散電源出力電圧Ｖｃと分散電源出力電流ｉｃを入力し、過電圧または過電流である場合は、配電系統遮断器解列指令ＶＣＢを出力し遮断器７を解列する。

【０１０８】送電系統、配電系統ともに正常である場合は、出力電圧指令発生装置４３は、必要な電圧指令Ⓢｏ

ｕｔを制御信号発生装置４４へ出力する。

【０１０９】制御信号発生装置４４は、制御信号Ⓢｇを図１の系統連系変換器又は発電機１４に出力する。この系統連系変換器又は発電機１４は、制御信号Ｖｇを入力し、図３に示す出力電圧Ⓢｃを発生する。これにより連系リアクトル１２に図３に示す電圧ベクトル△Ｖが印加される。この電圧ベクトル△Ｖにより連系リアクトル１２に図３に示す有効電流Ｉｓｓが流れる。その結果分散電源から配電系統と送電系統に対して電力が送電される。

【０１１０】第２の実施形態によっても、図１の負荷１０の急変時にも高速に配電系統の電圧を所要の精度に制御するとともに系統との間において余剰・不足電力の売買を行うことができる。

【０１１１】＜第３の実施形態（請求項５，６に対応）＞第３の実施形態について、図５と図６を参照して説明する。図５は、第３の実施形態の全体の構成を示す図であり、前述した第１の実施形態と異なる点は、配電系統遮断器１１と連系リアクトル１２の接続点に遮断器２６を介して無効電力補償装置２７が接続されている点が相違する。無効電力補償装置２７は、配電系統の電圧を一定に制御するためのものである。

【０１１２】図６は、図５の分散電源の制御装置１６のみを示すブロック図であり、制御装置１６は、位相制御装置７１と、出力電圧指令発生装置７２と、制御信号発生装置７３と、配電系統遮断器制御装置７５と、送電系統遮断器制御装置７４から構成されている。

【０１１３】位相制御装置７１は、図５の商用電源１の出力電圧の位相角指令θrefと商用電源の系統電圧検出値Ｖｓを入力し電圧指令Ｖrefを出力するものである。出力電圧指令発生装置７２は電圧指令Ｖrefを入力し出力電圧指令Ｖoutを発生するものである。制御信号発生装置７３は出力電圧指令Ｖoutを入力し、これに対応した制御信号Ｖｑを発生し、これを系統連系変換器又は発電機１４に出力するものである。

【０１１４】送電系統遮断器制御装置７４は、系統電圧検出値Ｖｓおよび系統電流検出値Ｉｓを入力し、その値が指定値より小さい場合例えばゼロの場合は分散電源の単独運転を防止するために送電系統遮断器７に対して制御信号（送電系統遮断器解列指令）ＶSBを出力し、送電系統遮断器７を解列するものである。

【０１１５】配電系統遮断器制御装置７５は、分散電源出力電圧Ｖｃおよび分散電源出力電流Ｉｃを入力しその値が指定値より大きい場合、過電圧、過電流を防止するために配電系統遮断器１１に対して制御信号（配電系統遮断器解列指令）ＶCBを出力し、配電系統遮断器１１をする解列するものであるこのような構成のものにおいて、送電系統、配電系統ともに正常である場合は、分散電源の制御装置１６において、位相制御装置７１は、出力電圧の位相角指令θrefと系統電圧検出値Ｖｓを入力し、電圧指令Ｖrefを出力電圧指令発生装置７２に出力すると、出力電圧指令発生装置７２は出力電圧指令Ｖoutを制御信号発生装置７３に与えると、制御信号発生装置７３は、制御信号Ｖｑを系統連系変換器または発電機１４に出力する。この系統連系変換器または発電機１４は、制御信号Ｖｑを入力すると、図３に示す分散電源出力電圧Ｖｃを発生する。これにより連系リアクトル１２に図３に示す電圧ベクトル△Ｖが印加される。

【０１１６】この電圧により連系リアクトル１２に有効電流Ⓘssが流れる。その結果分散電源から配電系統と送電系統に対して電力が送電される。

【０１１７】以上述べた第３の実施形態によると、無効電力補償装置２７により配電系統の電圧を一定に制御しながら系統電圧に対する位相制御により容易に系統との間で電力の売買電を行うことができる。

【０１１８】＜第４の実施形態（請求項７に対応）＞第４の実施形態について、図７を参照して説明する。図７は、第４の実施形態における分散電源システムの全体を示す構成図である。この場合は、共通配電線０８に図１と同様な構成の分散電源システムが複数個連系されるように構成したものである。

【０１１９】各分散電源システムの分散電源の制御装置１６は、電圧一定制御を行い送電を行う。

【０１２０】第４の実施形態によると、配電系統に接続された複数の分散電源が配電系統の電圧を一定に制御することができる。これにより配電系統の電圧の安定性を高め信頼性を向上することができる。

【０１２１】＜第５の実施形態（請求項８に対応）＞第５の実施形態について、図８を参照して説明する。図８は、図１の第１の実施形態と異なる点は、送電系統遮断器７と配電線８の間に、直列補償装置２８とリアクトル２９の直列回路が新たに接続されている点のみである。

【０１２２】この場合、分散電源の制御装置１６は、配電系統の電圧を一定に制御しながら、直列補償装置２８により送電系統に電圧が印加され、リアクトル２９に電圧がかけられることにより、配電系統から送電系統に対して電力供給を行う。

【０１２３】第５の実施形態によると分散電源の制御装置１６は配電系統の電圧を一定に維持しながら、直列補償装置２８により送電電力量を制御することにより効率的な売買電を実現できる。

【０１２４】＜第６の実施形態（請求項９に対応）＞第６の実施形態について、図９により参照して説明する。図８と異なる点は、共通配電線０８に、図８のリアクトル２９と直列補償装置２８を除いた分散電源システムが複数個接続されている点が相違する。共通配電線０８に接続された複数の分散電源システムは、すべて電圧制御を行い、配電線８の電圧を一定に制御する。送電系統と配電系統の連系線上の直列補償装置２８は、リアクトル２９に電圧を印加することにより売買電を行う。

【０１２５】第６の実施形態によると、複数の分散電源システムの制御装置は、配電系統の電圧を一定に維持しながら、直列補償装置により送電電力量を制御することにより効率的な売買電を実現することができる。

【０１２６】＜第７の実施形態（請求項１０に対応）＞第７の実施形態について、図１０を参照して説明する。図１０は、図９のシステムの構成は同じであるが、次の点のみが異なる。すなわち、共通配電線０８に接続された１台の分散電源システムは電圧制御を行うように構成し、共通配電線０８に接続された他の分散電源システムにおける分散電源の制御装置は、電流制御を行う。この場合、送電系統と配電系統の連系線上の直列補償装置２８は、リアクトル２９に電圧を印加することにより売買電を行う。

【０１２７】第７の実施形態によると、１台の分散電源の制御装置により配電系統の電圧を一定に制御しながら、他の分散電源の制御装置は電流制御を行い、所定の電力を送電し、直列補償装置により全体の送電電力量を制御することができる。

【０１２８】＜第８の実施形態（請求項１１に対応）＞第８の実施形態について、図１１を参照して説明する。送電系統は、電圧Ｖｓの商用電源１、送電線２、遮断器３を介して接続される負荷４、遮断器５を介して接続される配電用変電所内の変圧器６の２次側に接続される配電系統から構成される。

【０１２９】配電系統は、共通配電線０８に接続される複数の分散電源システムから構成される。各分散電源システムは、送電系統遮断器７、リアクトル２９、直列補償装置２８、遮断器９を介した負荷１０、配電系統遮断器１１を介した連系リアクトル１２、変換器用変圧器１３、系統連系変換器または発電機１４、直流電源または内燃・外燃機関１５、分散電源の制御装置１６から構成される。

【０１３０】分散電源の制御装置１６は、配電変電所の変圧器６の２次側の電圧を計測する電圧検出器１７と系統電流を検出する電流検出器１８とから系統電圧と系統電流を入力するとともに、連系リアクトル１２の１次側の電圧検出器１９と電流検出器２０から出力電圧と出力電流を入力する。

【０１３１】この配電系統においては、共通配電線０８に接続された１台の分散電源システムのみが電流制御を行い、共通配電線０８に接続された他の分散電源システムは全て電圧制御を行う。

【０１３２】第８の実施形態によると、１台の分散電源のみが電流制御を行い、他の分散電源は電圧制御を行うことにより、配電系統の電圧を一定に制御しながら直列補償装置により送電電力を制御しながら送電系統との間で売買電を行うことができる。

【０１３３】＜第９の実施形態（請求項１２に対応）＞第９の実施形態について、図１２を参照して説明する。この実施形態においては、複数の商用電源１と、複数の送電線２からなる複数の送電系統が、リアクトル２９Ａと直列補償装置２８Ａからなる１個の直列回路によって連系される場合である。

【０１３４】具体的には、第１の商用電源１に接続されている第１の送電線２と、第２の商用電源１に接続されている第２の送電線２の間に、系統間リアクトル２９Ａと系統間直列補償装置２８Ａの直列回路を接続し、各送電線２，２にそれぞれ配電変電所の変圧器を介して共通配電線０８，０８を接続し、該各共通配電線０８，０８にそれぞれ遮断器９を介して複数の負荷１０を接続すると共に、該各負荷１０と各共通配電線０８，０８の間に、それぞれ送電系統遮断器７を介してリアクトル２９と直列補償装置２８からなる直列回路をそれぞれ接続し、該各配電線８，８に接続されている負荷１０に対応して設けられ、直流電源１５からの直流電力を交流電力に変換する系統連系変換器１４又は内燃・外燃機関１５からの回転エネルギーに基づき交流電力を発電する発電機１４から得られる分散電源の交流電力を、それぞれ連系リアクトル１２、配電系統遮断器１１を介して各配電線８に供給するように構成し、連系リアクトル１２の一次側に設けた系統電圧検出器１９からの系統電圧検出値及び系統電流検出器２０からの系統電流検出値を入力し、分散電源を制御する制御装置１６を備えたものである。

【０１３５】第９の実施形態によると、直列補償装置２８を有する複数の分散電源システムからなる第１及び第２の送電線２、２間に、系統間リアクトル２９Ａと系統間直列補償装置２８Ａからなる直列回路を接続することにより、複数の送電系統間での柔軟な電力融通を行うことができる。

【０１３６】＜第１０の実施形態（請求項１３に対応）＞第１０の実施形態について、図１３を参照して説明する。本実施形態は、図１２の実施形態と異なる点は、第１及び第２の送電線２，２間に、接続される系統間リアクトル２９Ａと系統間直列補償装置２８Ａの直列回路に、直列に交流スイッチ３０を接続した点であり、これ以外の点は、図１２と同一である。

【０１３７】第１０の実施形態によると、交流スイッチ３０を閉路させることにより、必要に応じて複数の配電系統間での柔軟な電力融通を行うことができる。

【０１３８】＜第１１の実施形態（請求項１４に対応）＞第１１の実施形態について、図１４を参照して説明する。この実施形態は、図１２の実施形態と異なる点は、第１及び第２の送電線２，２間に、接続される系統間リアクトル２９Ａと系統間直列補償装置２８Ａの直列回路に、並列に遮断器４７を接続した点であり、これ以外の構成は図１２と同一である。

【０１３９】第１１の実施形態によると、系統間直列補償装置２８Ａが故障した場合でも遮断器４７を閉入する

ことにより、確実に複数の配電系統間での柔軟な電力融通を行うことができる。

【０１４０】＜第１２の実施形態（請求項１５に対応）＞第１２の実施形態について、図１５を参照して説明する。この実施形態においては、図１４に示す実施形態の系統間リアクトル２９と系統間直列補償装置２８の直列回路に、これに並列に遮断器４７が接続された回路に、新たに交流スイッチ３０を直列に接続した点が、図１４とは異なる点である。

【０１４１】第１２の実施形態によると、必要に応じて複数の配電系統間を連系し系統間直列補償装置２８Ａにより柔軟な電力融通を行い、系統間直列補償装置２８Ａが故障した場合でも遮断器４７を閉入することにより確実に複数の配電系統間での柔軟な電力融通を行うことができる。

【０１４２】＜第１３の実施形態（請求項１６に対応）＞第１３の実施形態について、図１６を参照して説明する。この実施形態は、図１２の実施形態の送電線２，２間に接続されている系統間リアクトル２９Ａと系統間直列補償装置２８Ａの直列回路を設けずに、この部分に高調波抑制のためのアクティブフィルタ３２が接続された点のみが、図１２とは異なる点である。

【０１４３】第１３の実施形態によると、アクティブフィルタ３２により、高調波を抑制しながら、複数の配電系統間で柔軟な電力融通を行うことができる。

【０１４４】＜第１４の実施形態（請求項１７に対応）＞第１４の実施形態について、図１７を参照して説明する。この実施形態は、図１２の実施形態と同一構成で、送電線２，２間に系統間リアクトル２９Ａと系統間直列補償装置２８Ａの直列回路が接続され、これにより送電線２、２間の各分散電源システムを全て電圧制御しながら潮流制御するように構成した点が、図１２とは異なる点である。

【０１４５】第１４の実施形態によると、各配電系統の全分散電源により電圧制御を行うことにより各配電系統の電圧を一定に維持しながら複数の配電系統間で柔軟な電力融通を行うことができる。

【０１４６】＜第１５の実施形態（請求項１８に対応）＞第１５の実施形態について、図１８を参照して説明する。この実施形態は、図１２の実施形態と同一構成で、送電線２，２間に系統間リアクトル２９Ａと直列補償装置２８Ａの直列回路が接続され、これにより送電線２，２間の各分散電源システムを全て位相制御しながら潮流制御するように構成した点が、図１２とは異なる点である。

【０１４７】第１５の実施形態によると、各配電系統の全分散電源システムにより位相制御を行うことにより制御系の構成を容易にして複数の配電系統間で柔軟な電力融通を行うことができる。

【０１４８】【発明の効果】本発明によれば、複数の分散電源が配電系統に連系された場合でも配電系統の電圧を一定に制御し、負荷が増大した場合でも全体を停止することなしに運転を継続し、必要時には他の送電系統に高速に連系し複数の分散電源の協調制御するとともに所要の電力を送電系統に確実かつ効率的に送電し、複数の送電系統間でも電力融通制御を行うことができる分散電源システムを提供することができる。

【図面の簡単な説明】

【図１】本発明の分散電源システムの第１の実施形態における全体構成を示す図。

【図２】図１の分散電源の制御装置の構成を示すブロック図。

【図３】図１又は従来のベクトル図。

【図４】本発明の分散電源システムの第２の実施形態における分散電源の制御装置の構成を示すブロック図。

【図５】本発明の分散電源システムの第３の実施形態における全体構成を示す図。

【図６】図５の分散電源の制御装置の構成を示すブロック図。

【図７】本発明の分散電源システムの第４の実施形態における全体構成を示す図。

【図８】本発明の分散電源システムの第５の実施形態における全体構成を示す図。

【図９】本発明の分散電源システムの第６の実施形態における全体構成を示す図。

【図１０】本発明の分散電源システムの第７の実施形態における全体構成を示す図。

【図１１】本発明の分散電源システムの第８の実施形態における全体構成を示す図。

【図１２】本発明の分散電源システムの第９の実施形態における全体構成を示す図。

【図１３】本発明の分散電源システムの第１０の実施形態における全体構成を示す図。

【図１４】本発明の分散電源システムの第１１の実施形態における全体構成を示す図。

【図１５】本発明の分散電源システムの第１２の実施形態における全体構成を示す図。

【図１６】本発明の分散電源システムの第１３の実施形態における全体構成を示す図。

【図１７】本発明の分散電源システムの第１４の実施形態における全体構成を示す図。

【図１８】本発明の分散電源システムの第１５の実施形態における全体構成を示す図。

【図１９】従来のコージェネレーションシステムを説明するための図。

【図２０】従来の燃料電池発電システムを説明するための図。

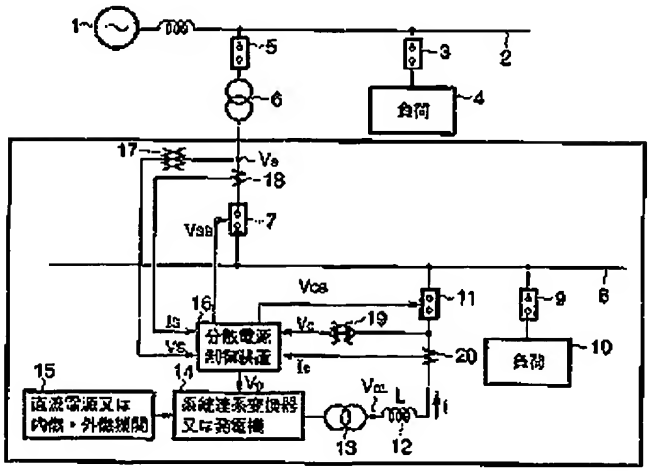
【図２１】従来の太陽光発電システム（独立システム）を説明するための図。

【図２２】従来の太陽光発電システム（系統連系システム）を説明するための図。
【図２３】従来の風力発電システム（独立システム）を説明するための図。
【図２４】従来の風力発電システム（系統連系システム）を説明するための図。
【図２５】従来の廃棄物発電システムを説明するための図。

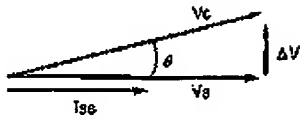
【符号の説明】

１…商用電源
２…送電線
３…遮断器
４…負荷
５…遮断器
６…配電変電所の変圧器
７…送電系統遮断器
８…配電線
０８…共通配電線
９…遮断器
１０…負荷
１１…配電系統遮断器
１２…連系リアクトル
１３…変換器用変圧器
１４…系統連系変換器または発電機
１５…直流電源または内燃・外燃機関
１６…分散電源の制御装置
１７…電圧検出器
１８…電流検出器
＊１９…電圧検出器
２０…電流検出器
２１…電流制御装置
２２…出力電圧指令発生装置
２３…制御信号発生装置
２４…送電系統遮断器制御装置
２５　配電系統遮断器制御装置
２６…遮断器
２７…無効電力補償装置
２８…直列補償装置
２８Ａ…系統間直列補償装置
２９…リアクトル
２９…系統間リアクトル
３０…交流スイッチ
３２…アクティブフィルタ
４１…電圧制御装置
４２…電流制御装置
４３…出力電圧指令発生装置
４４…制御信号発生装置
４５…送電系統遮断器制御装置
４６…配電系統遮断器制御装置
４７…遮断器
７１…位相制御装置
７２…出力電圧指令発生装置
７３…制御信号発生装置
７４…送電系統遮断器制御装置
７５…配電系統遮断器制御装置
＊

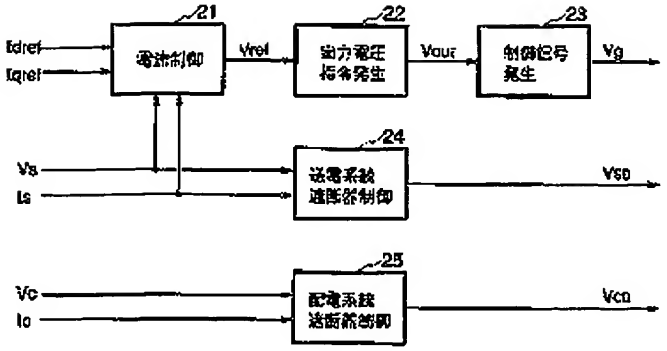
【図１】



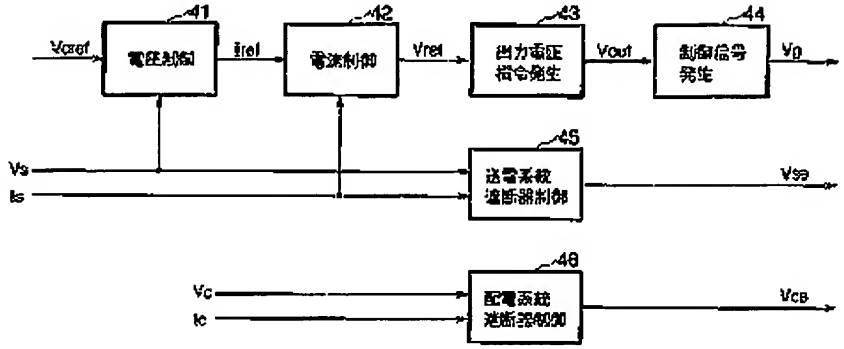
【図３】



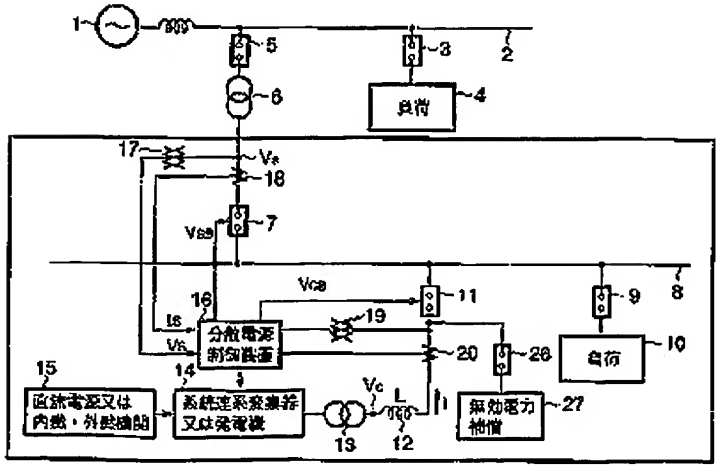
【図２】


21
22
23
Idref
Iqref
電流制御
Vref
出力電圧
指令発生
Vout
制御信号
発生
Vg
24
Vs
Is
送電系統
遮断器制御
Vso
25
Vc
Ic
配電系統
遮断器制御
Vco

【図４】


41
42
43
44
Vcref
電圧制御
Iref
電流制御
Vref
出力電圧
指令発生
Vout
制御信号
発生
Vg
45
Vs
Is
送電系統
遮断器制御
Vso
46
Vc
Ic
配電系統
遮断器制御
Vcb

【図５】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分散電源
制御装置
20
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負荷
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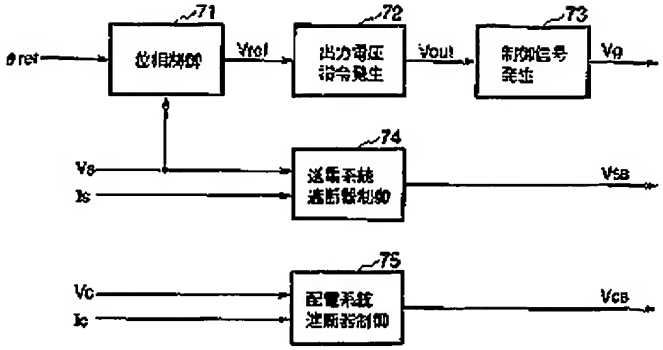
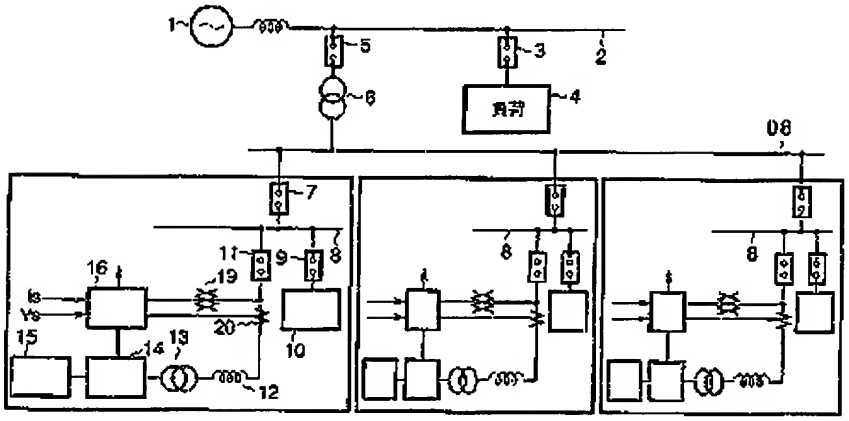
Vc
L
I
27
直流電源又は
内燃・外燃機関
系統連系変換器
又は発電機
有効電力
補償
13
12

【図6】


71
72
73
θref
位相制御
Vref
出力電圧指令発生
Vout
制御信号発生
Vg
74
Vs
Is
送電系統遮断器制御
VSB
75
Vc
Ic
配電系統遮断器制御
VCB

【図7】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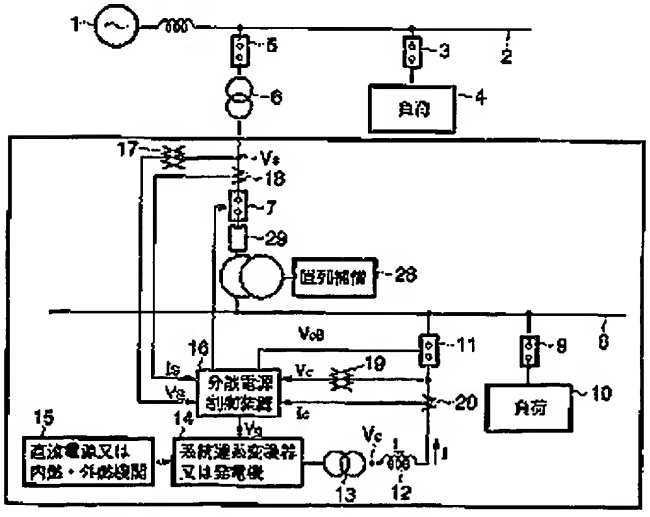
【図8】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負荷
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Vs
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7
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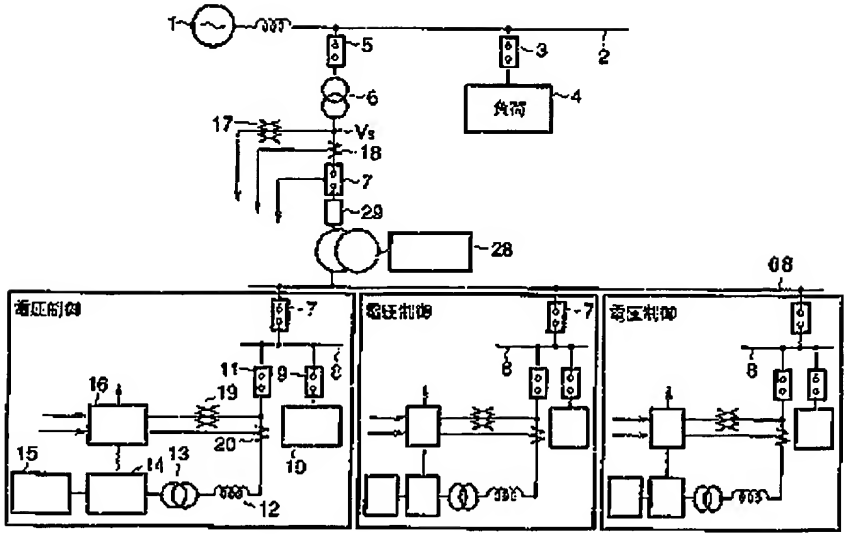
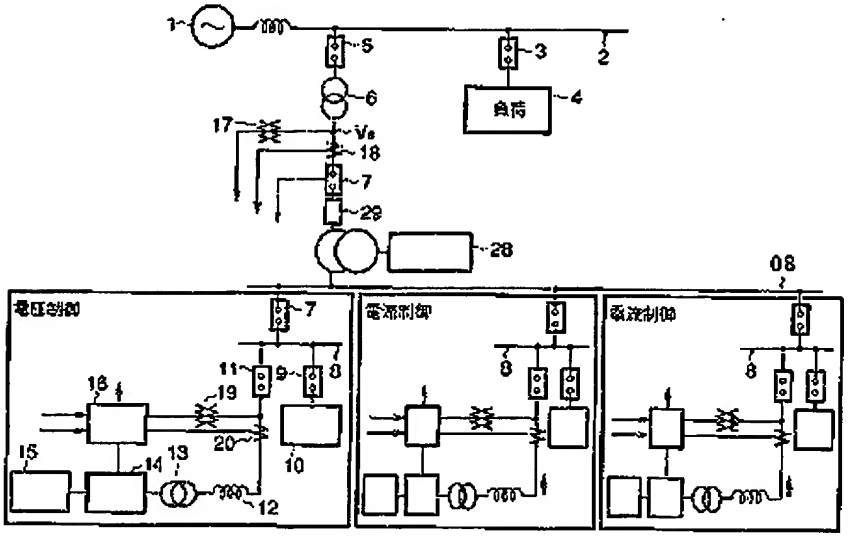
直列補償
28
VcB
16
11
9
8
19
Vc
Is
Vs
分散電源制御装置
20
負荷
10
15
14
Vs
Ic
直流電源又は内燃・外燃機関
系統連系変換器又は発電機
13
12

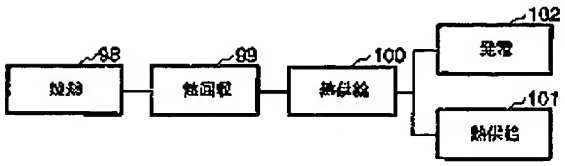
【図9】



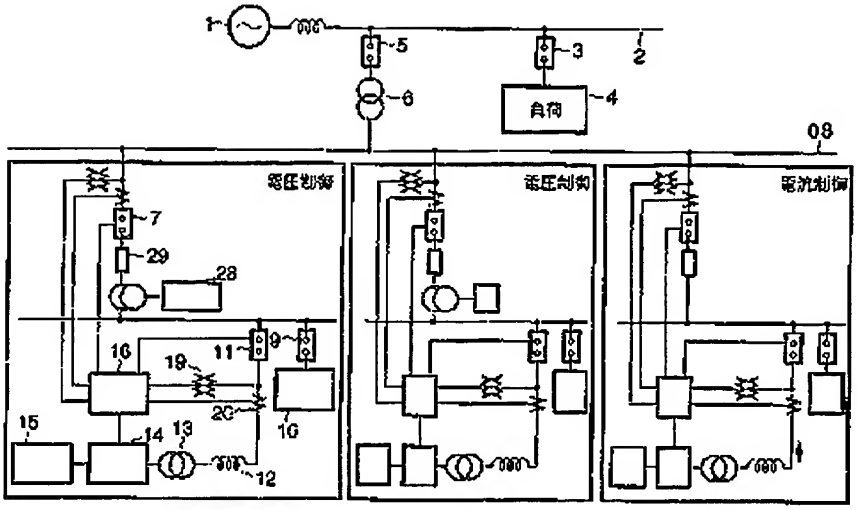
【図10】



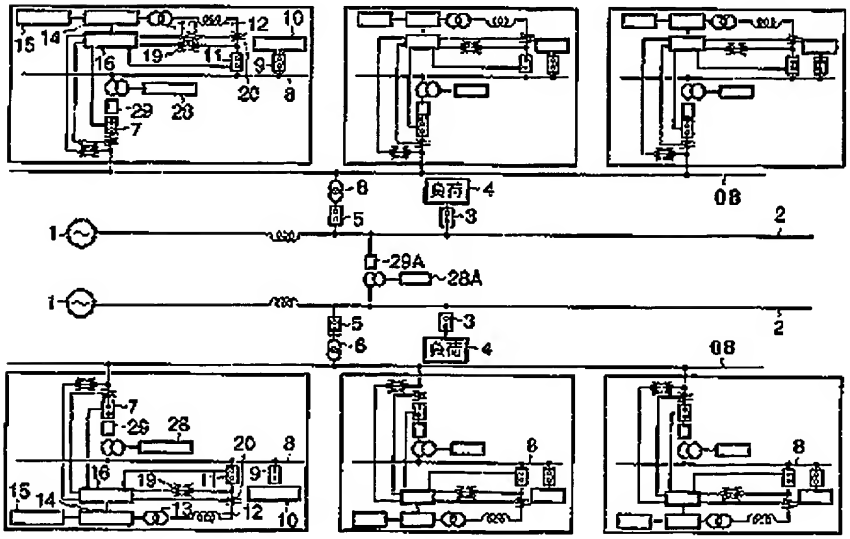
【図25】



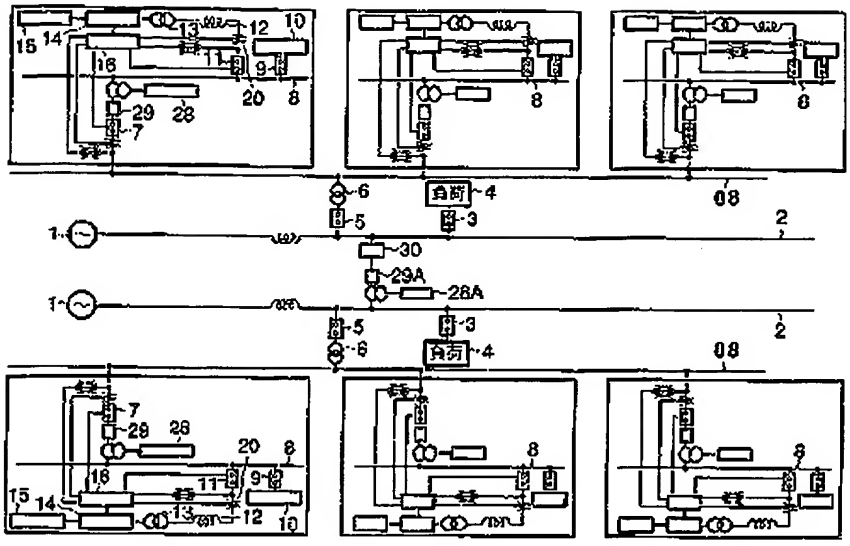
【図１１】



【図１２】



【図13】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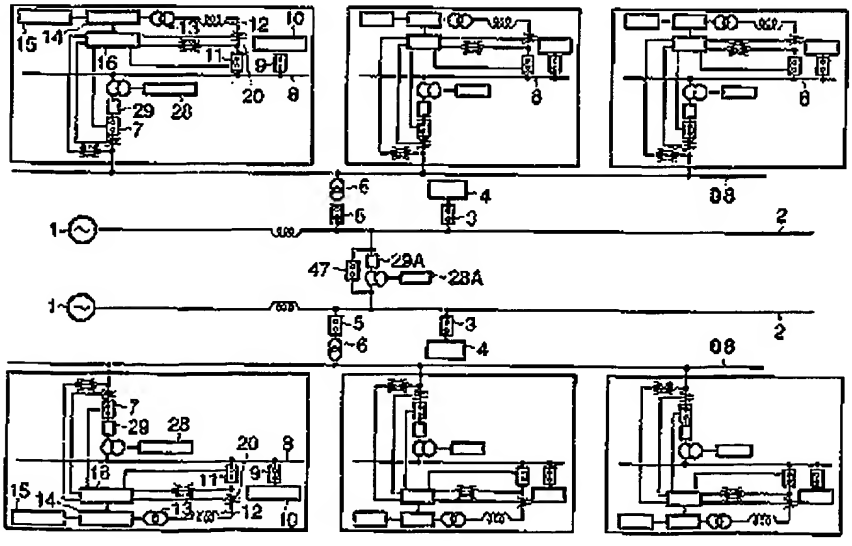
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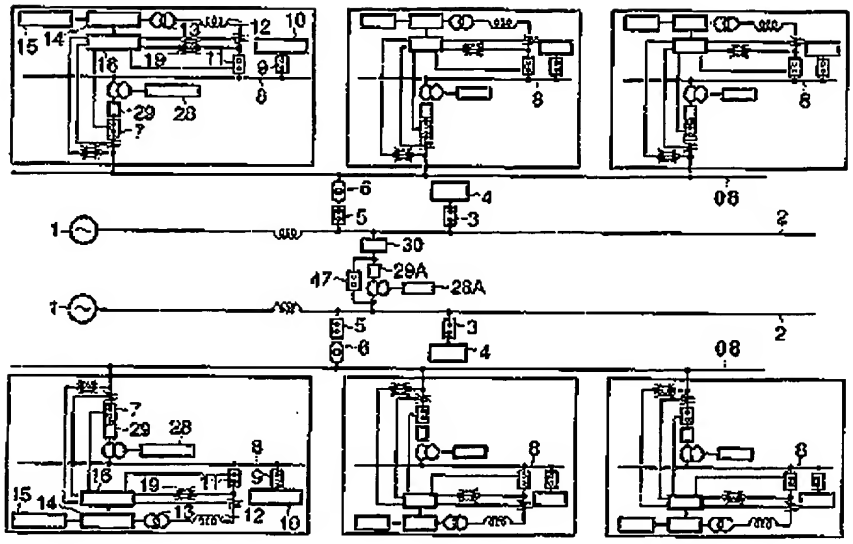
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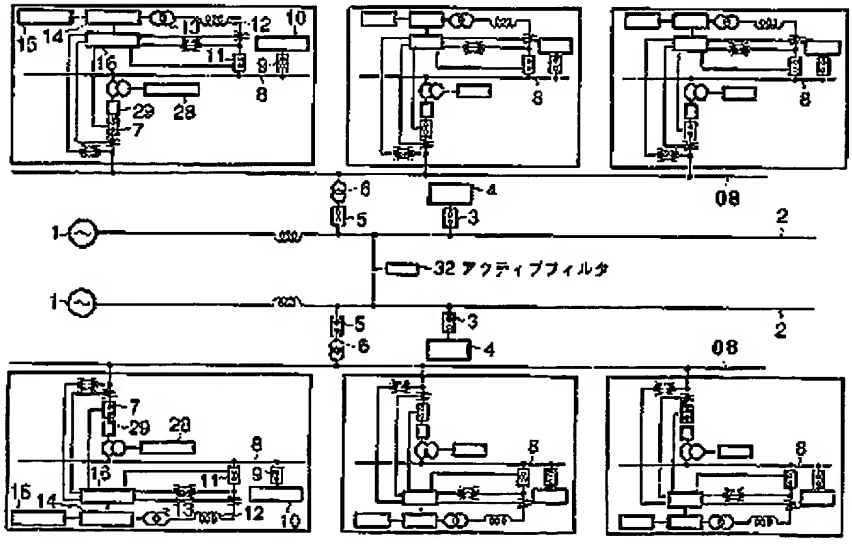
【図１６】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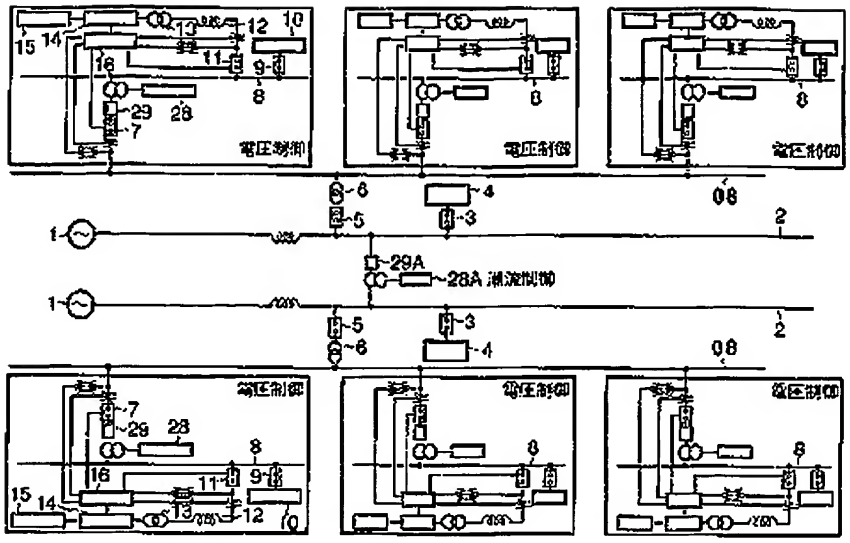
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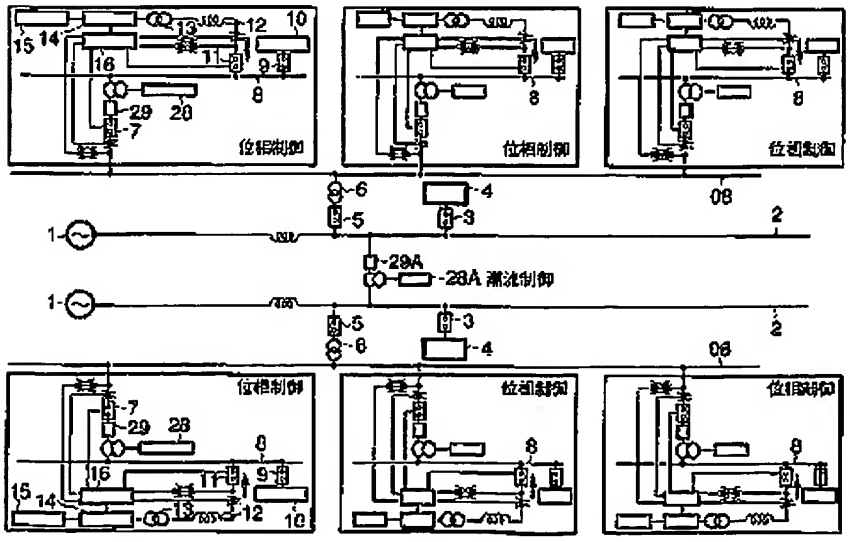
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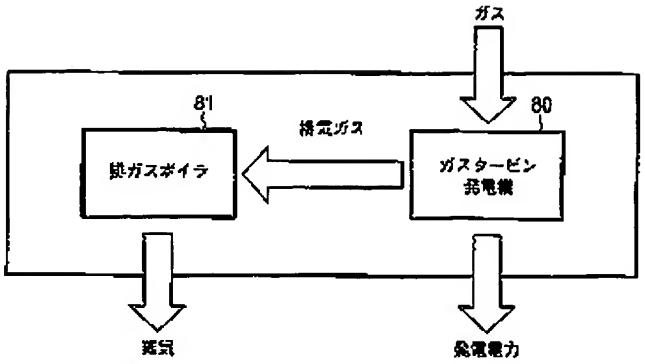

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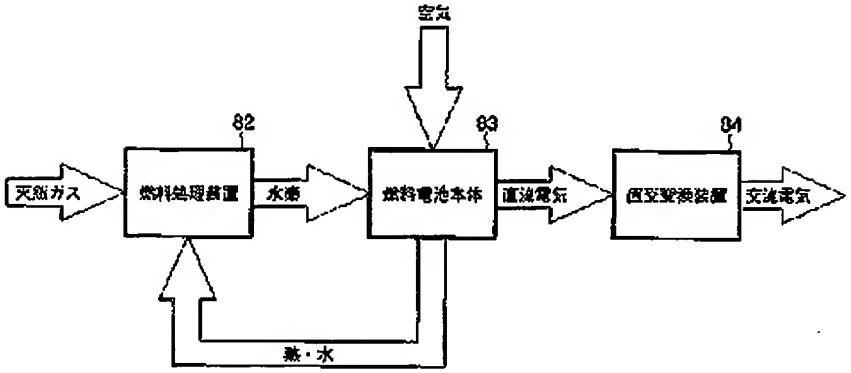

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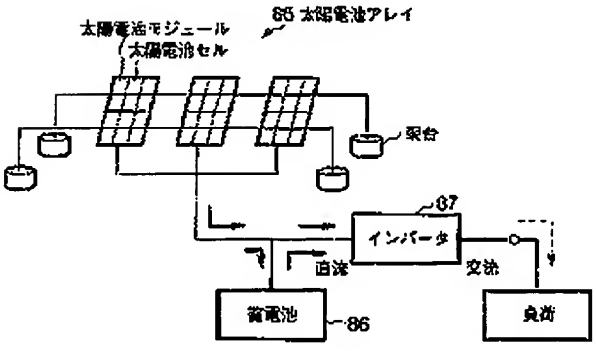

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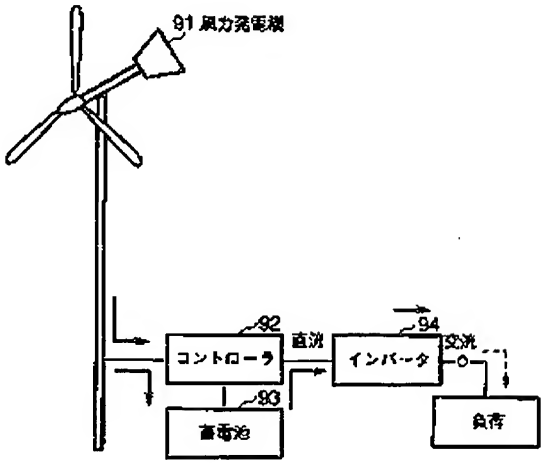

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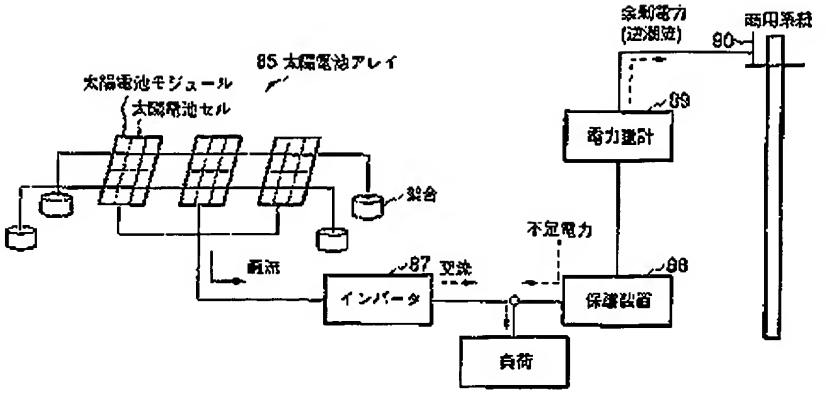

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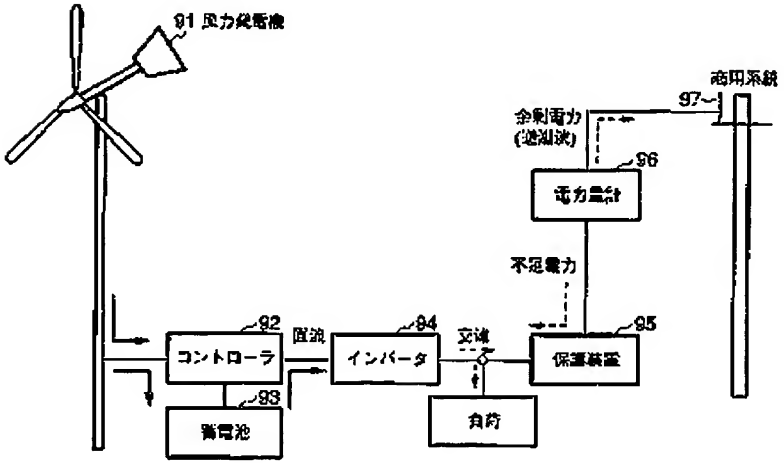

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5G066 DA04 DA08 FA01 FB11 FB17
FC11 HA19 HB02 HB05

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention supplies the power from a source power supply to a power distribution system through the closing motion means for power distribution, and relates to the distributed power-source system which supplied this power to the distributed power source acquired from a system-interconnection converter or a generator by this power distribution system through the closing motion means for distributed power sources, a link reactor, and a transformer.
[0002]
[Description of the Prior Art] The control unit of the conventional distributed power source is explained based on bibliography. Here, bibliography is in an Institute of Electrical Engineers of Japan, power and energy section, new and energy-saving technology committee, Institute of Electrical Engineers of Japan technical report, No. 609, and "city form distribution power-source system" city form distribution power-source system, the city mold distribution power-source system survey committee, and October, 1996. Drawing 1 shows the distributed power-source structure of a system of bibliography (as common as the outline configuration of this invention). The commercial network of a high order consists of a large-scale load 4 connected to the transmission line 2 connected to the source power supply 1, and a broadcasting electric wire through a breaker 3 and a breaker 5, and a transformer 6 in a distributing substation.
[0003] As for the power distribution system, the distribution line 8 is connected to the transformer 6 through the breaker 7. Distributed power-source systems aiming at the load 10 of a minor scale and power distribution in the area are consisted of through the breaker 9 and the breaker 11 by the distribution line 8.
[0004] A distributed power-source system consists of the link reactor 12, a transformer 13, a system-interconnection converter or a generator 14, DC power supply or internal combustion and an external combustion engine 15, and a control unit 16 of a distributed power source.
[0005] The vector diagram in the distributed power-source system of the former (this invention is also common) is shown in drawing 3 . DC power supply, or internal combustion and an external combustion engine 15 generates generating or power for direct current power if needed. A system-interconnection converter or a generator 14 inputs direct current power or power, is controlled by the control unit 16 of a distributed power source, and generates predetermined alternating current power. The control unit 16 of a distributed power source supplies electricity to the load of the region. When the load factor of the region goes up, the control unit 16 of a distributed power source carries out closed close [of the breaker 7], and receives transmitted electricity from a commercial network.
[0006] Moreover, also when the load factor of the region falls, the control unit 16 of a distributed power source carries out closed close [of the breaker 7], in order to carry out the electricity sales to utilities of the dump power.
[0007] Control **** 16 of a distributed power source detects the electrical potential difference and current of each point with the network electrical-potential-difference detector 17 attached in the primary

a breaker 7 side, and the electrical-potential-difference detector 17 and the current detector 18 which have been attached in the primary the network current detector 18 and the link reactor 12 side, and judges the individual-operation condition of a distributed power source. When the distributed power source is carrying out individual operation, parallel off of the breaker 7 is carried out, and the individual operation of a distributed power source is prevented.

[0008] There are the cogeneration system which used the gas engine etc., a fuel cell generation-of-electrical-energy system, a solar energy power generation system, a wind power system, and a generating-electricity-from-waste-materials system in the conventional distributed power source, and these are explained with reference to drawing 19 R> 9 - drawing 25 below.

[0009] Drawing 19 shows the conventional cogeneration system, and serves as a gas turbine generator 80 from an exhaust gas boiler 81, and a gas turbine generator 80 generates heat (exhaust gas) and the electrical and electric equipment (generated output) by using town gas etc. as a fuel. An exhaust gas boiler 81 is the ** energy system which is going to acquire high thermal efficiency by collecting the exhaust gas which a gas turbine generator 80 generates.

[0010] 3,300,000kW or more is working by the October, 1996 current. There are most accommodations for a building application (21% of the whole). Moreover, the accommodations also of generation-of-electrical-energy capacity are max with 125 MW output (23%). The accumulating totals, the number of installation, and the generation-of-electrical-energy output of the installation number of cases are [diesel power plants] 54%, 57%, 55%, and max, respectively. In the installation number of cases of a fuel, the rate of a fuel oil is max at 45%. In a national level, the cogeneration system of the liquid fuel which is mainly concerned with a diesel power plant gets a majority. By generation-of-electrical-energy capacity, the rates of a fuel oil are 54% and the highest.

[0011] Drawing 20 shows the conventional fuel cell generation-of-electrical-energy system, and transforms the chemical energy of a fuel and an oxidizer into electrical energy continuously in an isothermal process. A fuel cell generation-of-electrical-energy system consists of a fuel processing unit 82, a body 83 of a fuel cell, and an inverter unit 84 fundamentally. As a fuel, hydrogen gas, natural gas, coal gas, petroleum, alcohols, etc. are used. A fuel processing unit 82 converts a original fuel into gas with many hydrogen components. The body 83 of a fuel cell generates direct current power by the electrochemical conversion reaction of a fuel and an oxidizer in an electrode. The principal parts of a fuel cell are an electrolyte and an electrode. An electrolyte has the function to distribute ion and an electron. Only ion passes through the interior and an electron is prevented. A generation-of-electrical-energy function is in an electrode. The chemical energy which a fuel has is transformed into electrical energy with an electrode. As an oxidizer, air is mainly used. An inverter unit 84 changes the direct current power into alternating current power.

[0012] As a description of the power-proof network of a fuel cell, it can constitute from a conventional electric power plant easily for direct conversion. Moreover, since there is no rotator, inertia becomes comparatively small and an electric load effect can be followed promptly, it is effective in improvement in the stability of a power circuit, or dependability. Furthermore, since series connection of the component is electrically carried out in order to obtain high output voltage, the generation-of-electrical-energy system of various kinds of scales which the output voltage of arbitration is obtained and are crossed to the large range from the Koide force to high power with electrical-potential-difference class's optionality is possible.

[0013] In order for there to be no combustor part in that the noise by there being few mechanical parts is comparatively small as a description of the resistance to environment of a fuel cell, and a body and to convert hydrocarbon gas into gas with many hydrogen components with a fuel processing unit, there are little NOx in a body part and generating of CO.

[0014] Moreover, since the reuse of the unburnt gas is collected and carried out, the existence does not pose a big problem. Since it removes in the phase of fuel gas about a sulfur content, there is very little discharge from a fuel cell. Furthermore, it is CO2 [generating efficiency is high, and / since the partial load property is good / an inner external-combustion-engine generation of electrical energy of a comparable size]. There are few burst sizes.

[0015] As a description of the effectiveness of a fuel cell, since this electrochemical reaction transforms into direct electrical energy the free energy which a fuel has while being an isothermal reaction, it is not governed by the Carnot Hajime cycle but can expect high generating efficiency.
[0016] Moreover, it is highly maintainable like the time of partial load effectiveness being rated operation. The conventional distributed power-source system aims at performing power distribution to the region. Power receiving (purchased power) or electricity sales to utilities is performed by cooperating for a commercial network at the time of the need.
[0017] As a noncommercial fuel cell, development progresses most and there is a phosphoric-acid form fuel cell to be in the phase of commercialization. This fuel cell is manufactured from the thing with a magnitude of several 10kW to the thing of about ten MW scale. A DC to AC converter consists of an inverter, an output transformer, an alternating-current filter, etc. The IGBT component etc. is adopted as a main circuit of an inverter.
[0018] As control, there is an example of self-excitation type electrical-potential-difference form PWM. efficient [also at the time of network agitation, a current control function is added so that stable operation can be continued, and] -- and -- high -- the converter [****] is completed. In order to control a higher harmonic wave, 4 bridge 24 phase multiplex system is used.
[0019] Furthermore, the individual-operation detection function made into **** at the time of the head-tide style link based on a system-interconnection guideline is included in inverter control. As operation mode, it corresponds to a system interconnection and self-sustaining. Moreover, by the standby mode, we decided to carry out standby MODOHE shift independently at the time of interruption of service of an external power distribution system, it could respond to the prompt electric power supply initiation after interruption-of-service restoration, and starting and a halt which affects a battery life are avoided if possible. Furthermore, although the area of use of power is main, the network HE head-tide style of the part for a surplus is carried out, or it is performing power receiving power control. As an operation gestalt, fixed output operation and output-control operation are performed.
[0020] it is expected that this system contributes also to the peak shaving of a commercial power network by using sunlight by drawing 21 and drawing 22 showing the conventional solar energy power generation system, and they are the thing which consists of the solar-battery array 85, a battery 86, and an inverter 87 or the solar-battery array 85, an inverter 87, a protective device 88, a watthour meter 89, and the new energy system that consists of a commercial network 90 and that is.
[0021] It decides upon the "new energy fundamental principles" which shows introductory promotion of rationalization, the ED, a standardization, etc. of introductory exchange and regulation also as a country, and promotion of the installation is aimed at.
[0022] This system has the description in adequate supply, the earth environmental preservation, and **** NERUGI of energy. As characteristic engine performance, it is (1). Generating efficiency is not based on the size of a scale, but it is regularity and (2) mostly. It occurs that the selection range of (3) generation-of-electrical-energy capacity (light-receiving area) where the degree of freedom of a generation-of-electrical-energy system is large can use it as large (4) DC power supplies etc.
[0023] It sets in dependability and is (1). Since it is a perfect quiescence machine, it is reliable (2). Since it operates certainly in an emergency, it is reliable (3). There are the advantages, such as becoming backup of other generations of electrical energy.
[0024] Economical efficiency is (1). An energy source is (2) which is no charge in an inexhaustible supply since it is the sun. Sunlight is (3) which is a deployment of abandonment energy. (5) which can expect (4) economy of scale which is rich in mass-production nature (6) with the unnecessary running cost of a fuel, a lubricating oil, cooling water, etc. (7) which is energy saving (8) with short energy-recovery time amount It is mentioned that the transportation cost of an energy source is unnecessary etc.
[0025] Moreover, as an advantage in operability, it is (1). Sunlight can be used in almost all the locations on the earth. (2) (3) with simple operation, maintenance, and check Automation and full automation [easy] (4) (5) which can be generated in a consumer place Do not need utilities, such as auxiliary power, a fuel, and cooling water, for an emergency, either. (6) As an independent source of power transmission non-furnished areas, such as a detached island, a mountains zone, a desert, a prairie,

and an undeveloped area, effective and environment nature, (7) Since the amount of moving part is not like (9) rotating machines which are a pollution-free system since sunlight does not have worries about environmental pollution, such as (8) exhaust air which is a pollution-free energy source since it is clean, and exhaust heat, it is, so that there are no problems, such as noise, vibration, and friction.
[0026] It is as [demerit] follows. It sets for the engine performance and is (1). Since energy density is small, it is (2) with a large installation tooth space. (3) by which a generation-of-electrical-energy output is influenced by the meteorological condition (weather) Nighttime has the demerit of being unable to generate electricity. In the demerit of economical efficiency, the cost of equipment is a high point.
[0027] As demerit of operability, it is (1). It is (2) which needs the direct current and conversion into ac by the inverter 1 when AC power supply is required. (3) which needs a battery in order to acquire a stable power source at SIGMET and Nighttime, when a generation-of-electrical-energy output is low When forming a battery, it is mentioned that an installation tooth space needs reservation, maintenance, and to be checked.
[0028] A solar battery transforms light energy into direct electrical energy using the quantum photoelectric effect of a semi-conductor. A solar battery consists of p-n junction of a semi-conductor. If light is irradiated by this, an electron and an electron hole will occur. This serves as a carrier. By the electric field of the p-n junction section, an electron can be drawn near to n form and an electron hole can be drawn near to p form. Consequently, p form is just charged by n form in negative. Therefore, if a load is connected between p form and n form, a current flows and power can be taken out. Output maximum electric power changes in proportion [almost] to the intensity of light.
[0029] The solar battery with which are satisfied of all the fields of effectiveness, dependability, and cost is the crystal system (a single crystal, polycrystal, a polycrystal thin film, in addition to this) of silicon. The conventional stand-alone system is independent of commercial power. The power consumption of a load is covered only with the power of photovoltaics. (1) A gap remote district, (2) developing countries, and (3) The generation-of-electrical-energy system for carrying / migration, and (4) It is used by the one system of a solar battery, a battery, and a load etc. What panel-ized the cel, and a call and a cel for the solar battery is called module. A module is a practical unit. A poor thing is called array if it is need number of sheets about a module.
[0030] The power generated with the solar battery is preferentially used for the conventional system-interconnection system, and it compensates it with insufficient power from a source power supply. When the output of a solar battery is insufficient, it changes to electric power system. (System without a head-tide style) It always connects with electric power system, and when the power generated with the solar battery exceeds power consumption, the head-tide style of the dump power is carried out, and it carries out electricity sales to utilities. (System with a head-tide style) The link protective device for the protection at the time of connecting with electric power system and a safety check is added. The Invar evening detects the abnormalities of a solar battery or electric power system, and has the function of a system stop. There are a third harmonic wave electrical-potential-difference strain rapid increase detection method and a frequency shift method as an individual-operation detection function.
[0031] It sets in economical efficiency and the advantage is (1). (2) without the need of conserving power An expensive battery is needlessness and (3). It is (6) which supplies power to the load in an area the (5) daytime which can carry out the electricity sales to utilities of the dump power to an electric power company. There is the advantage of supplying electric power to a load with the power of an electric power company at night. Moreover, it sets in effectiveness and is (1). (2) A consumer is not dependent on change and the weather of intensity of radiation, and has the advantages -- an electric power supply can receive. [effective in the peak shaving of summer]
[0032] Drawing 23 and drawing 24 show the conventional wind power system, and a wind power system consists of generation-of-electrical-energy systems which consist of the aerogenerator 91 which has Rota used as a driving source, a controller 92 and a battery 93, and an inverter 94. As Rota, the propeller form shows large number of people. With a generator, there are a synchronous machine, an induction machine, and an adjustable-speed system.
[0033] First, the description of a propeller form has little torque fluctuation for every rotation, and the

advantage has self-driving force in respect of the engine performance, and is that rotational frequency adjustment and output adjustment are possible to some extent by pitch control. Moreover, in respect of an environment, it is clean and the point which is an inexhaustible supply is the description.
[0034] Demerit is (1) in an engine-performance side. The point that the amount of resources of a system is large is raised considering [with low (2) air density / from which the amount of existing changes in time or locally] (3) output capacitances.
[0035] moreover, economical efficiency -- setting -- (1) (2) which needs . tower in a propeller form the control for link operation with an advanced induction machine -- unnecessary -- cost -- cheap -- reliable (3) the adjustable-speed system is expensive -- etc. -- it is characteristic. At a controllability, it is (1). Since the rotational frequency adjustment for taking a synchronization is difficult for (2) synchronous machines which need azimuth control in a propeller form, they do not have the possibility of utilization. Furthermore, in respect of an environment, a technical problem is in the field of the noise, a scene, and safety.
[0036] Drawing 25 shows the conventional generating-electricity-from-waste-materials system, and the generating-electricity-from-waste-materials system is expected at the point supported from an energy side to a contaminant problem. This system consists of a contaminant incineration-equipment 98 -> recuperator 99 -> heat feeder 100 -> heat feeder 101 -> power plant 102. Most recovery energy is the systems of the instant form which cannot perform storage and conveyance. As a description, it is (2) with large (1) output in respect of the engine performance first. It is the stable power source. Moreover, it sets in effectiveness and is (1). (2) which promotes resource-ization of a contaminant (3) which promotes reuse of a contaminant The point of generating a lot of dump power is got.
[0037] In the armature-voltage control at the time of head-tide style operation of the distributed power-source generation-of-electrical-energy system of ****, and reactive power control, in order to make it into the power receiving power-factor 1.0 at the time of power receiving, generator reactive power control made into the power receiving reactive power 10 was performed.
[0038] On the other hand, at the time of reverse power transmission, in order to maintain the electrical potential difference of a power distribution system uniformly, power receiving point power-factor fixed control is performed. When the generator of a distributed power source is taking out power during a commercial network and link operation to the commercial network side, it becomes the direction where the electrical potential difference by the side of a commercial network rises. When the electrical potential difference by the side of a commercial network rises too much, fault will occur to the load connected into the same network.
[0039] Therefore, it is necessary to take out power to a commercial network side, stopping a power surge as much as possible. The power surge of a linking point is expressed by the outline degree type.
[0040]
delta V1 (R-P+X-Q)/Vs (1)
It is R-P+X-Q=0 in order to make into zero the reactance of resistance of the effective power sent into a network from P= distribution power-source generation-of-electrical-energy system, the reactive power sent into a network from Q= distribution power-source generation-of-electrical-energy system, Vs= network electrical potential difference, and R= link line, and X= link line, therefore the power surge value of a linking point here. (2)
What is necessary is just to control reactive power Q to effective power P to become.
[0041] That is, like, what is necessary is just to accept reactive power, it is from a network side, in proportion to the power which is shown by the degree type and which is sent out to a commercial network side, and it is **.
[0042] Q=-(R/X)P (3
That is, what is necessary will be just to accept reactive power from a network side in proportion to the power sent out to a commercial network. In this case, as a generator of a distributed power source, since it becomes the direction of a phase leading operating range, control of the phase advance capacitor connected to the operation-at-leading-power-factor limitation and yard network of a generator takes cautions.

[0043]
[Problem(s) to be Solved by the Invention] As a technical problem of a cogeneration system, they are a fuel, a noise problem, etc. The example especially with many inverter-related troubles of the electrical and electric equipment and control is reported [in / on the field of dependability, and / in the technical problem of a fuel cell / the trouble of a plant]. Therefore, the further improvement is needed for dependability, efficient-izing, endurance, and a price side.
[0044] As demerit of photovoltaics, it sets for the engine performance and is (1). Since energy density is small, it is (2) with a large installation tooth space. (3) Nighttime when a generation-of-electrical-energy output is influenced by the meteorological condition (weather) has the demerit of being unable to generate electricity. The demerit of economical efficiency is the point that the cost of equipment is high.
[0045] The demerit of operability is (1). It is (2) which needs the direct current and conversion into ac by the inverter when AC power supply is required. (3) which needs a battery in order to acquire a stable power source at SIGMET and Nighttime, when a generation-of-electrical-energy output is low When forming a battery, it is mentioned that an installation tooth space needs reservation, maintenance, and to be checked.
[0046] Environment nature of photovoltaics is good at the point of using natural energy. However, generating of energy 1 is unstable and there are many problems also in the point of ****. As a future technical problem, it sets to the field of manufacturing-technology development of the solar battery which aims at high performance and low cost, and is (1). It is necessary to advance utilization research of a thin form polycrystal solar-battery manufacturing technology, utilization research of (2) thin-film-solar-cell manufacture ****, and utilization research of a (3) super-effectiveness solar battery.
[0047] Moreover, in the field of the system ED which masters a solar battery well, it is (1). The plant research on a system interconnection, and (2) The plant research on the various system technologies of independent distribution, the plant research on (3) power distribution system, and (4) It is required to do amelioration research of the component engineering and (5) system-evaluation researches.
[0048] Furthermore, as a technical problem in circumference ED, it is (1). The efficient compact inverter for system-interconnection residences (transformer loess), and (2) Evaluation of a system-interconnection control technique, and (3) A new style battery and (4) A building-materials one form module and (5) There is the variety installation approach of PV array etc.
[0049] As other technical problems, there are the actual proof trial of a solar energy power generation system, an international joint research actual proof, the Fiji BIRII tee study, weather investigation, IEA solar energy power generation system research cooperation, etc.
[0050] It sets in a configuration and the technical problem of an aerogenerator is the formation of (1) lightweight, and (2). Slimming and (3) The technical problem of simplification occurs. Moreover, it is utilization in an area with little [regionality / application] abundance. Furthermore, in an environment, a technical problem is in the noise and a scene. The technical problem of reduction of employment expense occurs about maintainability.
[0051] a generation-of-electrical-energy control system -- an engine-performance side -- (1) Expansion of the wind-speed range which can be operated, and (2) wind direction -- improvement in the correspondence possibility to - wind speed fluctuation, and (3) The technical problem of improvement in fate system possibility with a small and weak network, improvement in the quality of the power at the time of (4) low-power output, the power conversion that makes (5) mass system possible, and development of a control system occurs.
[0052] Environment nature of wind power is good like photovoltaics at the point of using natural energy. However, generating of energy is unstable too and there are many problems also in points, such as a point of a scale, and noise.
[0053] As a technical problem of a generating-electricity-from-waste-materials system, it is (1). Maximization of effectiveness, and (2) There are items, such as administrative technical-problem (law constraint [of location], environmental problem, regulation, technical side) and (3) economy.
[0054] There are the following problems in the power distribution system which has two or more distributed power sources which consist of such various kinds of distributed power sources.

[0055] It was difficult 1st for a technical problem to be in the electrical-potential-difference stability of a power distribution system at the time of sudden change of a load, and to control a network electrical potential difference for a necessary precision by the low-speed nature of switch actuation of a capacitor.
[0056] When two or more distributed power sources were installed in the 2nd by the same power distribution system, the cooperative control was difficult.
[0057] **** by which the control unit of the conventional distributed power source supplies [the 3rd] power to a full load at coincidence at the place base which the number of a load increased was difficult.
[0058] When transmission system needed [4th] necessary power, it was difficult to control to supply this capacity easily as the whole power distribution system.
[0059] About power interchange, AC power transmission is performed through the conventional substation, and the problem was [5th] in the sake at the effectiveness.
[0060] To link [6th] two or more networks in a substation, it is required to carry out closed close [of low-speed breaker], and the technical problem occurred in the endurance, dependability, and the engine performance.
[0061] It was difficult for the 7th to control a higher harmonic at the time of link.
[0062] The purpose of this invention controls the electrical potential difference of a power distribution system uniformly, even when two or more distributed power sources are linked with a power distribution system. Continue operation, without stopping the whole, even when a load increases, link with a high speed at other transmission system at the time of the need, and the cooperative control of two or more distributed power sources, then necessary power are both transmitted to transmission system certainly and efficiently. It is offering the distributed power-source system which can perform power-interchange control also among two or more transmission system.
[0063]
[Means for Solving the Problem] In order to attain said purpose, invention corresponding to claim 1 The power from a source power supply The transmission line, the transformer of a distribution substation, a transmission system breaker, The alternating current power of the distributed power source acquired from the generator which generates alternating current power based on the rotational energy from the system-interconnection converter, or the internal combustion and the external combustion engine which supplies the load connected to this distribution line through the distribution line, and changes the direct current power from DC power supply into alternating current power A link reactor, Constitute so that said distribution line may be supplied through a power-distribution-system breaker, and the network electrical-potential-difference detection value from a network detector and network current detection value which were prepared in the upstream of said link reactor are inputted. In the distributed power-source system equipped with the control unit which controls said distributed power source said control unit While inputting said network electrical-potential-difference detection value and a network current detection value, in order to input an output active current command and an output reactive current command and to keep constant the electrical potential difference of said distribution line, it is the distributed power-source system which supplied power to said distributed power source, compensating reactive power.
[0064] In order to attain said purpose, invention corresponding to claim 2 As a control unit according to claim 1, a current control unit and an output voltage command generator, It consists of a control signal generator, a power-distribution-system breaker control unit, and a transmission system breaker control unit. It is what outputs an electrical-potential-difference command to which said current control unit inputs said output active current command, said output reactive current command, a network electrical-potential-difference detection value, and a network current detection value into, and reactive power becomes zero. It is what said output voltage command generator inputs said electrical-potential-difference command, and generates the output voltage command which said system-interconnection converter or generator can generate. Said control signal generator inputs the output voltage command from said output voltage command generator, and generates an output-control signal. It is the thing which gives this output-control signal to said system-interconnection converter or generator and to carry out. Said transmission system breaker control unit inputs the network electrical-potential-difference

detection value detected by said detector, and said network current detection value. It is what outputs a control signal to said transmission system breaker in order to prevent the individual operation of said distributed power source, when the value is smaller than an assignment value. Said power-distribution-system breaker control unit is a distributed power-source system which is what outputs a control signal to said power-distribution-system breaker, in order to input the output voltage of said distributed power source, and the output current of said distributed power source, and to prevent an overvoltage and an overcurrent, when the value is larger than an assignment value.

[0065] Said control unit is the distributed power-source system by which invention corresponding to [in order to attain said purpose] claim 3 supplied power to said distributed power source while inputting said network electrical-potential-difference detection value and the network current detection value in the above-mentioned distributed power-source system and compensating reactive power in order to input an output voltage command and to keep constant the electrical potential difference of said distribution line.

[0066] In order to attain said purpose, invention corresponding to claim 4 As a control unit according to claim 3, armature-voltage control equipment and a current control unit, An output voltage command generator, a control signal generator, and a power-distribution-system breaker control unit, Consist of a transmission system breaker control unit, and said armature-voltage control equipment inputs said output voltage command and said network electrical-potential-difference detection value. It is what outputs a current command to which reactive power becomes zero, and said current control unit inputs the current command from said armature-voltage control equipment, and said network current detection value, and outputs an electrical-potential-difference command. It is what said output voltage command generator inputs the electrical-potential-difference command from said armature-voltage control equipment, and generates the output voltage command which said system-interconnection converter or a generator can generate. It is what said control signal generator inputs the output voltage command from said output voltage command generator, and generates an output-control signal. Said transmission system breaker control unit inputs the network electrical-potential-difference detection value detected by said detector, and said network current detection value. It is what outputs said transmission system breaker control signal in order to prevent the individual operation of said distributed power source, when the value is smaller than an assignment value. Said power-distribution-system breaker control unit is a distributed power-source system which is what outputs a power-distribution-system breaker control signal, in order to input said distribution voltage and said power distribution current, and to prevent an overvoltage and an overcurrent, when the value is larger than an assignment value.

[0067] According to invention corresponding to either claim 1 - claim 4, while controlling the electrical potential difference of a power distribution system for a necessary precision and saving electricity at a high speed also at the time of sudden change of a load, the electricity sales to utilities of a surplus and insufficient power can be performed between networks.

[0068] In order to attain said purpose, invention corresponding to claim 5 is a distributed power-source system which keeps constant the electrical potential difference of said distribution line in the above-mentioned distributed power-source system, while said control unit controls the phase to the electrical potential difference of said distribution line.

[0069] In order to attain said purpose, invention corresponding to claim 6 As a control unit according to claim 5, phase control equipment and an output voltage generator, It consists of a control signal generator, a power-distribution-system breaker control unit, and a transmission system breaker control unit. It is what said phase control equipment inputs the network electrical-potential-difference detection value of the phase angle command of the output voltage of said source power supply, and said source power supply, and outputs an electrical-potential-difference command. It is what said output voltage generator inputs said electrical-potential-difference command, and generates an output voltage command. Said control signal generator is what generates the control signal corresponding to said output voltage command. Said transmission system breaker control unit inputs said network electrical-potential-difference detection value and said network current detection value. It is what outputs a control signal to said transmission system breaker in order to prevent the individual operation of said distributed

power source, when the value is smaller than an assignment value. Said power-distribution-system breaker control unit is a distributed power-source system which is what outputs a control signal to a power-distribution-system breaker, in order to input said distribution voltage and said power distribution current, and to prevent an overvoltage and an overcurrent, when the value is larger than an assignment value.

[0070] According to invention corresponding to claim 5 or claim 6, the phase control to a network electrical potential difference can perform ****** of power between networks easily, controlling the electrical potential difference of a power distribution system by the reactive power compensator uniformly.

[0071] Said each control unit is the distributed power-source system by which invention corresponding to [in order to attain said purpose] claim 7 supplied power to said distributed power source while inputting said network electrical-potential-difference detection value and the network current detection value in the above-mentioned distributed power-source system and compensating reactive power in order to input an output active current command and an output reactive current command and to keep constant the electrical potential difference of said distribution line.

[0072] According to invention corresponding to claim 7, two or more distributed power sources **** (ed) by the power distribution system can control the electrical potential difference of a power distribution system uniformly. The stability of the electrical potential difference of a power distribution system can be raised by this, and dependability can be improved.

[0073] In order to attain said purpose, invention corresponding to claim 8 In the above-mentioned distributed power-source system, the series circuit of series compensation equipment is connected with a reactor between said transmission system breakers and said distribution lines. Said control unit Inputting an output active current command and an output reactive current command, and controlling the electrical potential difference of said distribution line uniformly, while inputting said network electrical-potential-difference detection value and a network current detection value It is the distributed power-source system which performs an electric power supply from said distribution line to said transmission line by impressing an electrical potential difference to said transmission line by said series compensation equipment, and applying an electrical potential difference to said reactor.

[0074] According to invention corresponding to claim 8, the control unit of a distributed power source can realize efficient ****** by controlling power transmission electric energy by series compensation equipment, maintaining the electrical potential difference of a power distribution system uniformly.

[0075] In order to attain said purpose, invention corresponding to claim 9 In the distributed power-source system equipped with two or more control units which control two or more above-mentioned distributed power sources The series circuit of series compensation equipment is connected with a reactor between said transmission system breakers and said distribution lines. Said each control unit Inputting an output active current command and an output reactive current command, and controlling the electrical potential difference of said distribution line uniformly, while inputting said network electrical-potential-difference detection value and a network current detection value It is the distributed power-source system which performs an electric power supply from said distribution line to said transmission line by impressing an electrical potential difference to said transmission line by said series compensation equipment, and applying an electrical potential difference to said reactor.

[0076] According to invention corresponding to claim 9, the control unit of two or more distributed power-source systems can realize efficient ****** by controlling power transmission electric energy by series compensation equipment, maintaining the electrical potential difference of a power distribution system uniformly.

[0077] In order to attain said purpose, invention corresponding to claim 10 In the distributed power-source system equipped with two or more control units which control two or more above-mentioned distributed power sources The series circuit of series compensation equipment is connected with a reactor between said transmission system breakers and said distribution lines. Said each control unit While inputting said network electrical-potential-difference detection value and a network current detection value, an output active current command and an output reactive current command are inputted.

It is the distributed power-source system which one set only of said distributed power source performs armature-voltage control with said control unit, and performs an electric power supply from said distribution line to said transmission line while a distributed power source besides the remainder performs current control with a control unit besides the above and controls the electrical potential difference of said distribution line uniformly.

[0078] According to invention corresponding to claim 10, controlling the electrical potential difference of a power distribution system by the control unit of one set of a distributed power source uniformly, the control unit of other distributed power sources can perform current control, can transmit predetermined power, and can control the whole power transmission electric energy by series compensation equipment.

[0079] In order to attain said purpose, invention corresponding to claim 11 In the distributed power-source system equipped with two or more control units which control two or more above-mentioned distributed power sources The series circuit of series compensation equipment is connected with a reactor between said transmission system breakers and said distribution lines. Said each control unit While inputting said network electrical-potential-difference detection value and a network current detection value, an output active current command and an output reactive current command are inputted. It is the distributed power-source system which one set only of said distributed power source performs current control with said control unit, and performs an electric power supply from said distribution line to said transmission line while a distributed power source besides the remainder performs armature-voltage control with a control unit besides the above and controls the electrical potential difference of said distribution line uniformly.

[0080] According to invention corresponding to claim 11, when one set only of a distributed power source performs current control and other distributed power sources perform armature-voltage control, ****** can be performed between transmission system, controlling power transmission power by series compensation equipment controlling the electrical potential difference of a power distribution system uniformly.

[0081] In order to attain said purpose, invention corresponding to claim 12 Between the 1st transmission line connected to the 1st source power supply, and the 2nd transmission line connected to the 2nd source power supply While connecting the series circuit of the series compensation equipment between networks with the reactor between networks, connecting the distribution line to said each transmission line through the transformer of a distribution substation, respectively and connecting two or more loads to this each distribution line The series circuit which consists of a reactor and series compensation equipment through a transmission system breaker between this each load and said each distribution line is connected, respectively. The alternating current power of the distributed power source acquired from the generator which generates alternating current power based on the rotational energy from the system-interconnection converter, or the internal combustion and the external combustion engine which is formed corresponding to the load connected to this each distribution line, and changes the direct current power from DC power supply into alternating current power, respectively A link reactor, Constitute so that said each distribution line may be supplied through a power-distribution-system breaker, and the network electrical-potential-difference detection value from a network detector and network current detection value which were prepared in the upstream of said link reactor are inputted. It is the distributed power-source system which is equipped with the control unit which controls said distributed power source, and was made to perform power interchange between said 1st and 2nd transmission lines.

[0082] According to invention corresponding to claim 12, flexible power interchange between two or more power distribution systems can be performed by connecting between two or more power distribution systems which consist of two or more distributed power-source systems which have series compensation equipment with series compensation equipment.

[0083] In order to attain said purpose, invention corresponding to claim 13 is the distributed power-source system which connected the alternating current switch to the serial in the series circuit of the reactor between said networks connected between the 1st and 2nd transmission lines according to claim 12, and said series compensation equipment between networks.

[0084] According to invention corresponding to claim 13, flexible power interchange between two or more power distribution systems can be performed if needed by connecting with an alternating current switch between two or more power distribution systems which consist of two or more distributed power-source systems which have series compensation equipment with series compensation equipment.
[0085] In order to attain said purpose, invention corresponding to claim 14 is the distributed power-source system which connected the breaker to juxtaposition in the series circuit of the reactor between said networks connected between the 1st and 2nd transmission lines according to claim 12, and said series compensation equipment between networks.
[0086] According to invention corresponding to claim 14, by connecting with the breaker by which between two or more power distribution systems which consist of two or more distributed power-source systems which have series compensation equipment was connected to juxtaposition at series compensation equipment and it, even when series compensation equipment breaks down, flexible power interchange between two or more power distribution systems can be certainly performed by carrying out closed close [of the breaker].
[0087] In order to attain said purpose, invention corresponding to claim 15 is the distributed power-source system which connected the alternating current switch to the serial at these while connecting a breaker to juxtaposition in the series circuit of the reactor between said networks connected between the 1st and 2nd transmission lines according to claim 12, and said series compensation equipment between networks.
[0088] By connecting with the breaker by which between two or more power distribution systems which consist of two or more distributed power-source systems which have series compensation equipment was connected to juxtaposition at series compensation equipment and it with an alternating current switch according to invention corresponding to claim 15 Between two or more power distribution systems is linked if needed, series compensation equipment performs flexible power interchange, and even when series compensation equipment breaks down, flexible power interchange between two or more power distribution systems can be certainly performed by carrying out closed close [of the breaker].
[0089] In order to attain said purpose, invention corresponding to claim 16 Between the 1st transmission line connected to the 1st source power supply, and the 2nd transmission line connected to the 2nd source power supply While connecting the series circuit of the series compensation equipment between networks with the reactor between networks, connecting the distribution line to said each transmission line through the transformer of a distribution substation, respectively and connecting two or more loads to this each distribution line The series circuit which consists of a reactor and series compensation equipment through a transmission system breaker between this each load and said each distribution line is connected, respectively. The alternating current power of the distributed power source acquired from the generator which generates alternating current power based on the rotational energy from the system-interconnection converter, or the internal combustion and the external combustion engine which is formed corresponding to the load connected to this each distribution line, and changes the direct current power from DC power supply into alternating current power, respectively A link reactor, Constitute so that said each distribution line may be supplied through a power-distribution-system breaker, and the network electrical-potential-difference detection value from a network detector and network current detection value which were prepared in the upstream of said link reactor are inputted. It is the distributed power-source system which is equipped with the control unit which controls said distributed power source, and was made to perform power interchange between said 1st and 2nd transmission lines.
[0090] According to invention corresponding to claim 16, flexible power interchange can be performed among two or more power distribution systems, controlling a higher harmonic by connecting between two or more power distribution systems which consist of two or more distributed power-source systems which have series compensation equipment with the distribution line which has an active filter.
[0091] In order to attain said purpose, invention corresponding to claim 17 Between the 1st transmission line connected to the 1st source power supply, and the 2nd transmission line connected to the 2nd source power supply While connecting the series circuit of the series compensation equipment between

networks with the reactor between networks, connecting the distribution line to said each transmission line through the transformer of a distribution substation, respectively and connecting two or more loads to this each distribution line The series circuit which consists of a reactor and series compensation equipment through a transmission system breaker between this each load and said each distribution line is connected, respectively. The alternating current power of the distributed power source acquired from the generator which generates alternating current power based on the rotational energy from the system-interconnection converter, or the internal combustion and the external combustion engine which is formed corresponding to the load connected to this each distribution line, and changes the direct current power from DC power supply into alternating current power, respectively A link reactor, Constitute so that said each distribution line may be supplied through a power-distribution-system breaker, and the network electrical-potential-difference detection value from a network detector and network current detection value which were prepared in the upstream of said link reactor are inputted. It is the distributed power-source system which carries out tidal-current control, having the control unit which controls said distributed power source, and carrying out armature-voltage control of all of the distributed power source of said both networks.

[0092] According to invention corresponding to claim 17, between two or more power distribution systems which consist of two or more distributed power-source systems which have series compensation equipment is connected with series compensation equipment, and flexible power interchange can be performed among two or more power distribution systems, maintaining uniformly the electrical potential difference of each power distribution system by performing armature-voltage control according to all the distributed power sources of each power distribution system.

[0093] In order to attain said purpose, invention corresponding to claim 18 Between the 1st transmission line connected to the 1st source power supply, and the 2nd transmission line connected to the 2nd source power supply While connecting the series circuit of the series compensation equipment between networks with the reactor between networks, connecting the distribution line to said each transmission line through the transformer of a distribution substation, respectively and connecting two or more loads to this each distribution line The series circuit which consists of a reactor and series compensation equipment through a transmission system breaker between this each load and said each distribution line is connected, respectively. The alternating current power of the distributed power source acquired from the generator which generates alternating current power based on the rotational energy from the system-interconnection converter, or the internal combustion and the external combustion engine which is formed corresponding to the load connected to this each distribution line, and changes the direct current power from DC power supply into alternating current power, respectively A link reactor, Constitute so that said each distribution line may be supplied through a power-distribution-system breaker, and the network electrical-potential-difference detection value from a network detector and network current detection value which were prepared in the upstream of said link reactor are inputted. It is the distributed power-source system which carries out tidal-current control, having the control unit which controls said distributed power source, and carrying out phase control of all of the distributed power source of said both networks.

[0094] According to invention corresponding to claim 18, between two or more power distribution systems which consist of two or more distributed power-source systems which have series compensation equipment is connected with series compensation equipment, by performing phase control according to all the distributed power sources of each power distribution system, the configuration of a control system can be made easy and flexible power interchange can be performed among two or more power distribution systems.

[0095]

[Embodiment of the Invention] <the 1st operation gestalt (it corresponds to claims 1 and 2)> -- the 1st operation gestalt is explained with reference to drawing 1 , drawing 2 , and drawing 3 . Drawing 1 is the block diagram showing the outline configuration of the 1st whole operation gestalt. To namely, the transmission line 2 which has the large-scale load 4 connected with a source power supply 1 through a breaker 3 The load 10 connected to the distribution line 8 connected to the transformer 6 of a

distributing substation connected through a breaker 5 through the transmission system breaker 7 through the breaker 9, The link reactor 12 connected to the distribution line 8 through the power-distribution-system breaker 11, A transformer 13, a system-interconnection converter or a generator 14, and the network electrical-potential-difference detector 17 attached in the primary DC power supply or internal combustion and an external combustion engine 15, and a breaker 7 side, The point equipped with the control unit 16 of the distributed power source which detects the electrical potential difference and current of each point with the network current detector 18, the electrical-potential-difference detector 19 attached in the primary the link reactor 12 side, and the current detector 20 is the same as that of the conventional distributed power-source system.

[0096] With the electrical-potential-difference detector 17 which measures the network electrical potential difference (detection value) Vs, i.e., the electrical potential difference of the secondary of the transformer 6 of a distribution substation, and the current detector 18 which detects the network current (detection value) Is, the control unit 16 of a distributed power source inputs the network current Is as the network electrical potential difference Vs, and inputs output voltage and the output current from the electrical-potential-difference detector 19 and the current detector 20 by the side of [the link reactor 12] primary.

[0097] Drawing 2 is a block diagram for explaining the concrete configuration of the control device 16 of the distributed power source in this operation gestalt. The current control unit 21 inputs the active current command Idref, the reactive current command Iqref, the network electrical potential difference (detection value) Vs, and the network current (detection value) Is, and outputs the electrical-potential-difference command Vref to the output voltage command generator 22.

[0098] The output voltage command generator 22 inputs the electrical-potential-difference command Vref from the current control unit 21, and when both transmission system (transmission line) 2 and the power distribution system (distribution line) 8 are normal, the output voltage command generator 22 outputs the required electrical-potential-difference command Vout to the control signal generator 23.

[0099] The control signal generator 23 inputs the electrical-potential-difference command Vout from the output voltage command generator 22, and outputs a control signal Vg to a system-interconnection converter or a generator 14. This system-interconnection converter or generator 14 inputs a control signal Vg, and generates the output voltage Vc shown in drawing 3 .

[0100] The transmission system breaker control unit 24 inputs the network electrical potential difference Vs and the network current Is, when the network electrical potential difference Vs or the network current Is is zero, for individual-operation prevention, outputs the network breaker parallel-off command VSB, and carries out parallel off of the breaker 7.

[0101] Moreover, the power-distribution-system breaker control unit 25 inputs the distributed power-outlet electrical potential difference Vc and the distributed power-outlet current Ic, and when it is an overvoltage or an overcurrent, it carries out parallel off of the power-distribution-system breaker 11.

[0102] Electrical-potential-difference vector deltaV which this shows to the link reactor 12 at drawing 3 is impressed. Active current **ss shown in the link reactor 12 by this electrical-potential-difference vector deltaV flows. Consequently, power is transmitted from a distributed power source to the distribution line 8 and the transmission line 6.

[0103] According to the 1st operation gestalt described above, while controlling the electrical potential difference of the distribution line 8 for a necessary precision and saving electricity at a high speed also at the time of sudden change of a load 10, the electricity sales to utilities of a surplus and insufficient power can be performed between networks.

[0104] <the 2nd operation gestalt (it corresponds to claims 3 and 4)> -- the 2nd operation gestalt is explained with reference to drawing 4 . Drawing 4 is the block diagram showing only the control device 16 of the distributed power source in drawing 1 of the 1st operation gestalt.

[0105] Namely, the armature-voltage control equipment 41 which outputs the current command Iref to which the output voltage command Vcref and the network electrical potential difference (detection value) Vs are inputted into, and reactive power becomes zero, The current control unit 42 which inputs the current command Iref and the network current (detection value) Is, and outputs the electrical-

potential-difference command Vref, It consists of an output voltage command generator 43 which inputs the electrical-potential-difference command Vref and generates the output voltage command Vout which can be generated, and a control signal generator 44 which inputs the output voltage command Vout and generates the output-control signal Vg.
[0106] The transmission system breaker control unit 45 inputs the network electrical potential difference Vs and the network current Is, when the network electrical potential difference Vs or the network current Is is zero, for individual-operation prevention, outputs the network breaker parallel-off command VSB, and carries out parallel off of the breaker 7.
[0107] Moreover, the power-distribution-system breaker control unit 46 carries out human power of the distributed power-outlet current Ic to the distributed power-outlet electrical potential difference Vc, when it is an overvoltage or an overcurrent, outputs the power-distribution-system breaker parallel-off command VCB, and carries out parallel off of the breaker 7.
[0108] When transmission system and a power distribution system are normal, the output voltage command generator 43 outputs required electrical-potential-difference command **out for them to the control signal generator 44.
[0109] The control signal generator 44 outputs control signal **g to the system-interconnection converter or generator 14 of drawing 1 . This system-interconnection converter or generator 14 inputs a control signal Vg, and generates output voltage **c shown in drawing 3 . Electrical-potential-difference vector deltaV which this shows to the link reactor 12 at drawing 3 is impressed. The active current Iss shown in the link reactor 12 by this electrical-potential-difference vector deltaV at drawing 3 flows. As a result, power is transmitted from a distributed power source to a power distribution system and transmission system.
[0110] While controlling the electrical potential difference of a power distribution system also by the 2nd operation gestalt for a necessary precision to a high speed also at the time of sudden change of the load 10 of drawing 1 , according to it, a surplus and insufficient power can be dealt in between networks.

[0111] <the 3rd operation gestalt (it corresponds to claims 5 and 6)> -- the 3rd operation gestalt is explained with reference to drawing 5 and drawing 6 . Drawing 5 is drawing showing the configuration of the 3rd whole operation gestalt, and, as for a different point from the 1st operation gestalt mentioned above, the point that the reactive power compensator 27 is connected with the power-distribution-system breaker 11 through the breaker 26 at the node of the link reactor 12 is different. The reactive power compensator 27 is for controlling the electrical potential difference of a power distribution system uniformly.
[0112] Drawing 6 is the block diagram showing only the control device 16 of the distributed power source of drawing 5 , and the control device 16 consists of phase control equipment 71, the output voltage command generator 72, a control signal generator 73, a power-distribution-system breaker control device 75, and a transmission system breaker control device 74.
[0113] Phase control equipment 71 inputs the network electrical-potential-difference detection value Vs of phase angle command thetaref of the output voltage of the source power supply 1 of drawing 5 , and a source power supply, and outputs the electrical-potential-difference command Vref. The output voltage command generator 72 inputs the electrical-potential-difference command Vref, and generates the output voltage command Vout. The control signal generator 73 inputs the output voltage command Vout, generates the control signal Vg corresponding to this, and outputs this to a system-interconnection converter or a generator 14.
[0114] The transmission system breaker control unit 74 inputs the network electrical-potential-difference detection value Vs and the network current detection value Is, when the value is smaller than an assignment value, in the case of zero, in order to prevent the individual operation of a distributed power source, a control signal (transmission system breaker parallel-off command) VSB is outputted to the transmission system breaker 7, and it carries out parallel off of the transmission system breaker 7.
[0115] The power-distribution-system breaker control unit 75 inputs the distributed power-outlet electrical potential difference Vc and the distributed power-outlet current Ic. When the value is larger

than an assignment value, In the thing of such a configuration of that it is a thing that outputs a control signal (power-distribution-system breaker parallel-off command) VCB to the power-distribution-system breaker 11 in order to prevent an overvoltage and an overcurrent, and carries out the power-distribution-system breaker 11 and that carries out parallel off When transmission system and a power distribution system are normal In the control unit 16 of a distributed power source phase control equipment 71 If phase angle command thetaref of output voltage and the network electrical-potential-difference detection value Vs are inputted and the electrical-potential-difference command Vref is outputted to the output voltage command generator 72 If the output voltage command generator 72 gives the output voltage command Vout to the control signal generator 73, the control signal generator 73 will output a control signal Vg to a system-interconnection converter or a generator 14. This system-interconnection converter or generator 14 will generate the distributed power-outlet electrical potential difference Vc shown in drawing 3 , if a control signal Vg is inputted. Electrical-potential-difference vector deltaV which this shows to the link reactor 12 at drawing 3 R> 3 is impressed.

[0116] Active current **ss flows to the link reactor 12 with this electrical potential difference. As a result, power is transmitted from a distributed power source to a power distribution system and transmission system.

[0117] According to the 3rd operation gestalt described above, the phase control to a network electrical potential difference can perform ****** of power between networks easily, controlling the electrical potential difference of a power distribution system by the reactive power compensator 27 uniformly.

[0118] <the 4th operation gestalt (it corresponds to claim 7)> -- the 4th operation gestalt is explained with reference to drawing 7 . Drawing 7 is the block diagram showing the whole distributed power-source system in the 4th operation gestalt. In this case, it constitutes so that two or more distributed power-source systems of the same configuration as drawing 1 may be linked with the common distribution line 08.

[0119] The control unit 16 of the distributed power source of each distributed power-source system transmits electricity by performing electrical-potential-difference fixed control.

[0120] According to the 4th operation gestalt, two or more distributed power sources connected to the power distribution system can control the electrical potential difference of a power distribution system uniformly. The stability of the electrical potential difference of a power distribution system can be raised by this, and dependability can be improved.

[0121] <the 5th operation gestalt (it corresponds to claim 8)> -- the 5th operation gestalt is explained with reference to drawing 8 . The point that drawing 8 differs from the 1st operation gestalt of drawing 1 is only a point that the series circuit of a reactor 29 is newly connected with series compensation equipment 28 between the transmission system breaker 7 and the distribution line 8.

[0122] In this case, controlling uniformly the electrical potential difference of . power distribution system, an electrical potential difference is impressed to transmission system by serial **** equipment 28, and the control unit 16 of a distributed power source performs an electric power supply from a power distribution system to transmission system by applying an electrical potential difference to a reactor 29.

[0123] According to the 5th operation gestalt, the control unit 16 of a distributed power source can realize efficient ****** by controlling power transmission electric energy by series compensation equipment 28, maintaining the electrical potential difference of a power distribution system uniformly.

[0124] <the 6th operation gestalt (it corresponds to claim 9)> -- drawing 9 refers and the 6th operation gestalt is explained. The point that two or more distributed power-source systems excluding [a different point from drawing 8] the reactor 29 and the series compensation equipment 28 of drawing 8 to the common distribution line 08 are connected is different. Two or more distributed power-source systems of all connected to the common distribution line 08 perform armature-voltage control, and control the electrical potential difference of the distribution line 8 uniformly. The series compensation equipment 28 on the link line of transmission system and a power distribution system performs ****** by impressing an electrical potential difference to a reactor 29.

[0125] According to the 6th operation gestalt, the control unit of two or more distributed power-source

systems can realize efficient ****** by controlling power transmission electric energy by series compensation equipment, maintaining the electrical potential difference of a power distribution system uniformly.

[0126] <the 7th operation gestalt (it corresponds to claim 10)> -- the 7th operation gestalt is explained with reference to drawing 10 . Although the structure of a system of drawing 10 of drawing 9 is the same, only the following points differ. That is, one set of the distributed power-source system connected to the common distribution line 08 is constituted so that armature-voltage control may be performed, and the control unit of the distributed power source in other distributed power-source systems connected to the common distribution line 08 performs current control. In this case, the series compensation equipment 28 on the link line of transmission system and a power distribution system performs ****** by impressing an electrical potential difference to a reactor 29.

[0127] According to the 7th operation gestalt, controlling the electrical potential difference of a power distribution system by the control unit of one set of a distributed power source uniformly, the control unit of other distributed power sources can perform current control, can transmit predetermined power, and can control the whole power transmission electric energy by series compensation equipment.

[0128] <the 8th operation gestalt (it corresponds to claim 11)> -- the 8th operation gestalt is explained with reference to drawing 11 . Transmission system consists of power distribution systems connected to the secondary of the transformer 6 in the distributing substation connected through the load 4 and breaker 5 which are connected through the source power supply 1 of an electrical potential difference Vs, the transmission line 2, and a breaker 3.

[0129] A power distribution system consists of two or more distributed power-source systems connected to the common distribution line 08. Each distributed power-source system consists of the transmission system breaker 7, a reactor 29, series compensation equipment 28, the load 10 through a breaker 9, the link reactor 12 through the power-distribution-system breaker 11, the transformer 13 for converters, a system-interconnection converter or a generator 14, DC power supply or internal combustion and an external combustion engine 15, and a control unit 16 of a distributed power source.

[0130] The control unit 16 of a distributed power source carries out the close mosquito of the output current to output voltage from the electrical-potential-difference detector 19 and the current detector 20 by the side of [the link reactor 12] primary while inputting a network electrical potential difference and a network current from the electrical-potential-difference detector 17 which measures the electrical potential difference of the secondary of the transformer 6 of a distribution substation, and the current detector 18 which detects a network current.

[0131] In this power distribution system, all other distributed power-source systems by which one set only of the distributed power-source system connected to the common distribution line 08 performed current control, and it was connected to the common distribution line 08 perform armature-voltage control.

[0132] According to the 8th operation gestalt, when one set only of a distributed power source performs current control and other distributed power sources perform armature-voltage control, ****** can be performed between transmission system, controlling power transmission power by series compensation equipment controlling the electrical potential difference of a power distribution system uniformly.

[0133] <the 9th operation gestalt (it corresponds to claim 12)> -- the 9th operation gestalt is explained with reference to drawing 12 . In this operation gestalt, two or more source power supplies 1 and two or more transmission system which consists of two or more transmission lines 2 are the cases where one series circuit which consists of reactor 29A and series compensation equipment 28A links.

[0134] Specifically between the 1st transmission line 2 connected to the 1st source power supply 1, and the 2nd transmission line 2 connected to the 2nd source power supply 1 The series circuit of reactor 29between networks A and series compensation equipment 28between networks A is connected. While connecting the common distribution lines 08 and 08 to each transmission lines 2 and 2 through the transformer of a distribution substation, respectively and connecting two or more loads 10 to these each common distribution lines 08 and 08 through a breaker 9, respectively The series circuit which consists of a reactor 29 and series compensation equipment 28 through the transmission system breaker 7,

respectively between this each load 10 and each common distribution lines 08 and 08 is connected, respectively. The alternating current power of the distributed power source acquired from the generator 14 which generates alternating current power based on the rotational energy from the system-interconnection converter 14, or the internal combustion and the external combustion engine 15 which is formed corresponding to the load 10 connected to these each distribution lines 8 and 8, and changes the direct current power from DC power supply 15 into alternating current power It constitutes so that each distribution line 8 may be supplied through the link reactor 12 and the power-distribution-system breaker 11, respectively. The network electrical-potential-difference detection value from the network electrical-potential-difference detector 19 formed in the upstream of the link reactor 12 and the network current detection value from the network current detector 20 are inputted, and it has the control unit 16 which controls a distributed power source.

[0135] According to the 9th operation gestalt, flexible power interchange between two or more transmission system can be performed by connecting the series circuit which consists of reactor 29between networks A, and series compensation equipment 28between networks A between the 1st and 2nd transmission lines 2 which consist of two or more distributed power-source systems which have series compensation equipment 28, and 2.

[0136] <the 10th operation gestalt (it corresponds to claim 13)> -- the 10th operation gestalt is explained with reference to drawing 13 . The point that this operation gestalt differs from the operation gestalt of drawing 12 is a point of having connected the alternating current switch 30 to the serial in the series circuit of reactor 29between networks A connected between the 1st and 2nd transmission lines 2 and 2, and series compensation equipment 28between networks A, and points other than this are the same as that of drawing 12 .

[0137] According to the 10th operation gestalt, flexible power interchange between two or more power distribution systems can be performed by carrying out close [of the alternating current switch 30] if needed.

[0138] <the 11th operation gestalt (it corresponds to claim 14)> -- the 11th operation gestalt is explained with reference to drawing 14 . The point that this operation gestalt differs from the operation gestalt of drawing 12 is a point of having connected the breaker 47 to juxtaposition in the series circuit of reactor 29between networks A connected between the 1st and 2nd transmission lines 2 and 2, and series compensation equipment 28between networks A, and the configuration of those other than this is the same as that of drawing 12 .

[0139] According to the 11th operation gestalt, even when series compensation equipment 28between networks A breaks down, flexible power interchange between two or more power distribution systems can be certainly performed by carrying out closed close [of the breaker 47].

[0140] <the 12th operation gestalt (it corresponds to claim 15)> -- the 12th operation gestalt is explained with reference to drawing 15 . In this operation gestalt, drawing 14 is the point of differing in that the alternating current switch 30 was newly connected to the serial in the circuit where the breaker 47 was connected to juxtaposition in the series circuit of the reactor 29 between networks of the operation gestalt shown in drawing 14 , and the series compensation equipment 28 between networks at this.

[0141] According to the 12th operation gestalt, between two or more power distribution systems is linked if needed, series compensation equipment 28between networks A performs flexible power interchange, and even when series compensation equipment 28between networks A breaks down, flexible power interchange between two or more power distribution systems can be certainly performed by carrying out closed close [of the breaker 47].

[0142] <the 13th operation gestalt (it corresponds to claim 16)> -- the 13th operation gestalt is explained with reference to drawing 16 . Drawing 12 is the point of differing in that the active filter 32 for a harmonic restraint was connected to this part, without this carried-out type bear preparing the series circuit of reactor 29between networks A connected between the transmission line 2 of the operation gestalt of drawing 12 , and 2, and series compensation equipment 28between networks A.

[0143] According to the 13th operation gestalt, flexible power interchange can be performed among two or more power distribution systems by the active filter 32, controlling a higher harmonic.

[0144] <the 14th operation gestalt (it corresponds to claim 17)> -- the 14th operation gestalt is explained with reference to drawing 17 . This operation gestalt is the same configuration as the operation gestalt of drawing 12 , and drawing 12 is the point that the points constituted so that tidal current control might be carried out while the series circuit of reactor 29between networks A and series compensation equipment 28between networks A was connected between the transmission line 2 and 2 and armature-voltage control of all of the transmission line 2 and each distributed power source system between two was carried out by this differ .

[0145] According to the 14th operation gestalt, flexible power interchange can be performed among two or more power distribution systems, maintaining uniformly the electrical potential difference of each power distribution system by performing armature-voltage control according to all the distributed power sources of each power distribution system.

[0146] <the 15th operation gestalt (it corresponds to claim 18)> -- the 15th operation gestalt is explained with reference to drawing 18 . drawing 12 be the point that the points constituted so that tidal current control might be carried out while the series circuit of reactor 29between networks A and series compensation equipment 28A be connected between the transmission line 2 and 2 and this carried - out type bear carried out phase control of all of the transmission line 2 and each distributed power source system between two by this with the same configuration as the operation gestalt of drawing 12 differ .

[0147] According to the 15th operation gestalt, by performing phase control by all the distributed power-source systems of each power distribution system, the configuration of a control system can be made easy and flexible power interchange can be performed among two or more power distribution systems.

[0148]

[Effect of the Invention] According to this invention, even when two or more distributed power sources are linked with a power distribution system, the electrical potential difference of a power distribution system is controlled uniformly. Continue operation, without stopping the whole, even when a load increases, link with a high speed at other transmission system at the time of the need, and the cooperative control of two or more distributed power sources, then necessary power are both transmitted to transmission system certainly and efficiently. The distributed power-source system which can perform power-interchange control also among two or more transmission system can be offered.

[Translation done.]

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing showing the whole configuration in the 1st operation gestalt of the distributed power-source system of this invention.
[Drawing 2] The block diagram showing the configuration of the control device of the distributed power source of drawing 1 .
[Drawing 3] Drawing 1 or the conventional vector diagram.
[Drawing 4] The block diagram showing the configuration of the control device of the distributed power source in the 2nd operation gestalt of the distributed power-source system of this invention.
[Drawing 5] Drawing showing the whole configuration in the 3rd operation gestalt of the distributed power-source system of this invention.
[Drawing 6] The block diagram showing the configuration of the control device of the distributed power source of drawing 5 .
[Drawing 7] Drawing showing the whole configuration in the 4th operation gestalt of the distributed power-source system of this invention.
[Drawing 8] Drawing showing the whole configuration in the 5th operation gestalt of the distributed power-source system of this invention.
[Drawing 9] Drawing showing the whole configuration in the 6th operation gestalt of the distributed power-source system of this invention.
[Drawing 10] Drawing showing the whole configuration in the 7th operation gestalt of the distributed power-source system of this invention.
[Drawing 11] Drawing showing the whole configuration in the 8th operation gestalt of the distributed power-source system of this invention.
[Drawing 12] Drawing showing the whole configuration in the 9th operation gestalt of the distributed power-source system of this invention.
[Drawing 13] Drawing showing the whole configuration in the 10th operation gestalt of the distributed power-source system of this invention.
[Drawing 14] Drawing showing the whole configuration in the 11th operation gestalt of the distributed power-source system of this invention.
[Drawing 15] Drawing showing the whole configuration in the 12th operation gestalt of the distributed power-source system of this invention.
[Drawing 16] Drawing showing the whole configuration in the 13th operation gestalt of the distributed power-source system of this invention.
[Drawing 17] Drawing showing the whole configuration in the 14th operation gestalt of the distributed power-source system of this invention.
[Drawing 18] Drawing showing the whole configuration in the 15th operation gestalt of the distributed power-source system of this invention.
[Drawing 19] Drawing for explaining the conventional cogeneration system.
[Drawing 20] Drawing for explaining the conventional fuel cell generation-of-electrical-energy system.

[Drawing 21] Drawing for explaining the conventional solar energy power generation system (stand-alone system).
[Drawing 22] Drawing for explaining the conventional solar energy power generation system (system-interconnection system).
[Drawing 23] Drawing for explaining the conventional wind power system (stand-alone system).
[Drawing 24] Drawing for explaining the conventional wind power system (system-interconnection system).
[Drawing 25] Drawing for explaining the conventional generating-electricity-from-waste-materials system.
[Description of Notations]
1 -- Source power supply
2 -- Transmission line
3 -- Breaker
4 -- Load
5 -- Breaker
6 -- Transformer of a distribution substation
7 -- Transmission system breaker
8 -- Distribution line
08 -- Common distribution line
9 -- Breaker
10 -- Load
11 -- Power-distribution-system breaker
12 -- Link reactor
13 -- Transformer for converters
14 -- A system-interconnection converter or generator
15 -- DC power supply, or internal combustion and an external combustion engine
16 -- Control unit of a distributed power source
17 -- Electrical-potential-difference detector
18 -- Current detector
19 -- Electrical-potential-difference detector
20 -- Current detector
21 -- Current control unit
22 -- Output voltage command generator
23 -- Control signal generator
24 -- Transmission system breaker control unit
25 Power-Distribution-System Breaker Control Unit
26 -- Breaker
27 -- Reactive power compensator
28 -- Series compensation equipment
28A -- Series compensation equipment between networks
29 -- Reactor
29 -- Reactor between networks
30 -- Alternating current switch
32 -- Active filter
41 -- Armature-voltage control equipment
42 -- Current control unit
43 -- Output voltage command generator
44 -- Control signal generator
45 -- Transmission system breaker control unit
46 -- Power-distribution-system breaker control unit
47 -- Breaker

71 -- Phase control equipment
72 -- Output voltage command generator
73 -- Control signal generator
74 -- Transmission system breaker control unit
75 -- Power-distribution-system breaker control unit

[Translation done.]

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CLAIMS

[Claim(s)]
[Claim 1] The power from a source power supply The transmission line, the transformer of a distribution substation, a transmission system breaker, The alternating current power of the distributed power source acquired from the generator which generates alternating current power based on the rotational energy from the system-interconnection converter, or the internal combustion and the external combustion engine which supplies the load connected to this distribution line through the distribution line, and changes the direct current power from DC power supply into alternating current power A link reactor, Constitute so that said distribution line may be supplied through a power-distribution-system breaker, and the network electrical-potential-difference detection value from a network detector and network current detection value which were prepared in the upstream of said link reactor are inputted. In the distributed power-source system equipped with the control unit which controls said distributed power source said control unit The distributed power-source system characterized by supplying power to said distributed power source while compensating reactive power in order to input an output active current command and an output reactive current command and to keep constant the electrical potential difference of said distribution line, while inputting said network electrical-potential-difference detection value and a network current detection value.
[Claim 2] Said control unit A current control unit, an output voltage command generator, and a control signal generator, It is what outputs an electrical-potential-difference command to which it becomes from a power-distribution-system breaker control unit and a transmission system breaker control unit, and said current control unit inputs said output active current command, said output reactive current command, a network electrical-potential-difference detection value, and a network current detection value into, and reactive power becomes zero. It is what said output voltage command generator inputs said electrical-potential-difference command, and generates the output voltage command which said system-interconnection converter or generator can generate. Said control signal generator inputs the output voltage command from said output voltage command generator, and generates an output-control signal. It is the thing which gives this output-control signal to said system-interconnection converter or generator and to carry out. Said transmission system breaker control unit inputs the network electrical-potential-difference detection value detected by said detector, and said network current detection value. It is what outputs a control signal to said transmission system breaker in order to prevent the individual operation of said distributed power source, when the value is smaller than an assignment value. Said power-distribution-system breaker control unit is a distributed power-source system according to claim 1 which is what outputs a control signal to said power-distribution-system breaker in order to input the output voltage of said distributed power source, and the output current of said distributed power source, and to prevent an overvoltage and an overcurrent, when the value is larger than an assignment value.
[Claim 3] The power from a source power supply The transmission line, the transformer of a distribution substation, a transmission system breaker, The alternating current power of the distributed power source acquired from the generator which generates alternating current power based on the rotational energy from the system-interconnection converter, or the internal combustion and the external combustion

engine which supplies the load connected to this distribution line through the distribution line, and changes the direct current power from DC power supply into alternating current power A link reactor, Constitute so that said distribution line may be supplied through a power-distribution-system breaker, and the network electrical-potential-difference detection value from a network detector and network current detection value which were prepared in the upstream of said link reactor are inputted. In the distributed power-source system equipped with the control unit which controls said distributed power source said control unit The distributed power-source system characterized by supplying power to said distributed power source while compensating reactive power in order to input an output voltage command and to keep constant the electrical potential difference of said distribution line, while inputting said network electrical-potential-difference detection value and a network current detection value.

[Claim 4] Said control unit Armature-voltage control equipment, a current control unit, and an output voltage command generator, It consists of a control signal generator, a power-distribution-system breaker control unit, and a transmission system breaker control unit. Said armature-voltage control equipment inputs said output voltage command and said network electrical-potential-difference detection value. It is what outputs a current command to which reactive power becomes zero, and said current control unit inputs the current command from said armature-voltage control equipment, and said network current detection value, and outputs an electrical-potential-difference command. It is what said output voltage command generator inputs the electrical-potential-difference command from said armature-voltage control equipment, and generates the output voltage command which said system-interconnection converter or a generator can generate. It is what said control signal generator inputs the output voltage command from said output voltage command generator, and generates an output-control signal. Said transmission system breaker control unit inputs the network electrical-potential-difference detection value detected by said detector, and said network current detection value. It is what outputs said transmission system breaker control signal in order to prevent the individual operation of said distributed power source, when the value is smaller than an assignment value. Said power-distribution-system breaker control unit is a distributed power-source system according to claim 3 which is what outputs a power-distribution-system breaker control signal in order to input said distribution voltage and said power distribution current, and to prevent an overvoltage and an overcurrent, when the value is larger than an assignment value.

[Claim 5] The power from a source power supply The transmission line, the transformer of a distribution substation, a transmission system breaker, The alternating current power of the distributed power source acquired from the generator which generates alternating current power based on the rotational energy from the system-interconnection converter, or the internal combustion and the external combustion engine which supplies the load connected to this distribution line through the distribution line, and changes the direct current power from DC power supply into alternating current power A link reactor, The reactive power compensator which constituted so that said distribution line might be supplied through a power-distribution-system breaker, and was connected to said system-interconnection converter or generator, In the distributed power-source system equipped with the control unit which inputs the network electrical-potential-difference detection value from a network detector and network current detection value which were prepared in the upstream of said link reactor, and controls said distributed power source Said control unit is a distributed power-source system characterized by keeping constant the electrical potential difference of said distribution line, controlling the phase to the electrical potential difference of said distribution line.

[Claim 6] Said control unit Phase control equipment, an output voltage generator, and a control signal generator, It is what it consists of a power-distribution-system breaker control unit and a transmission system breaker control unit, and said phase control equipment inputs the network electrical-potential-difference detection value of the phase angle command of the output voltage of said source power supply, and said source power supply, and outputs an electrical-potential-difference command. It is what said output voltage generator inputs said electrical-potential-difference command, and generates an output voltage command. Said control signal generator is what generates the control signal corresponding to said output voltage command. Said transmission system breaker control unit inputs

said network electrical-potential-difference detection value and said network current detection value. It is what outputs a control signal to said transmission system breaker in order to prevent the individual operation of said distributed power source, when the value is smaller than an assignment value. Said power-distribution-system breaker control unit is a distributed power-source system according to claim 5 which is what outputs a control signal to a power-distribution-system breaker in order to input said distribution voltage and said power distribution current, and to prevent an overvoltage and an overcurrent, when the value is larger than an assignment value.

[Claim 7] The power from a source power supply The transmission line, the transformer of a distribution substation, a transmission system breaker, Two or more loads connected to this distribution line through the distribution line are supplied. The alternating current power of two or more distributed power sources acquired from two or more generators which generate alternating current power based on the rotational energy from two or more system-interconnection converter, or two or more internal combustion and external combustion engines which changes the direct current power from two or more DC power supplies into alternating current power It constitutes so that said distribution line may be supplied through two or more link reactors and two or more power-distribution-system breakers. In the distributed power-source system equipped with two or more control units which input the network electrical-potential-difference detection value from two or more network detectors and network current detection value which were prepared in the upstream of each of said link reactor, and control said two or more distributed power sources While said each control unit inputs said network electrical-potential-difference detection value and a network current detection value The distributed power-source system characterized by supplying power to said distributed power source while compensating reactive power in order to input an output active current command and an output reactive current command and to keep constant the electrical potential difference of said distribution line.

[Claim 8] The power from a source power supply The transmission line, the transformer of a distribution substation, a transmission system breaker, The alternating current power of the distributed power source acquired from the generator which generates alternating current power based on the rotational energy from the system-interconnection converter, or the internal combustion and the external combustion engine which supplies the load connected to this distribution line through the distribution line, and changes the direct current power from DC power supply into alternating current power A link reactor, Constitute so that said distribution line may be supplied through a power-distribution-system breaker, and the network electrical-potential-difference detection value from a network detector and network current detection value which were prepared in the upstream of said link reactor are inputted. In the distributed power-source system equipped with the control unit which controls said distributed power source, the series circuit of series compensation equipment is connected with a reactor between said transmission system breakers and said distribution lines. Said control unit Inputting an output active current command and an output reactive current command, and controlling the electrical potential difference of said distribution line uniformly, while inputting said network electrical-potential-difference detection value and a network current detection value The distributed power-source system characterized by performing an electric power supply from said distribution line to said transmission line by impressing an electrical potential difference to said transmission line by said series compensation equipment, and applying an electrical potential difference to said reactor.

[Claim 9] The power from a source power supply The transmission line, the transformer of a distribution substation, a transmission system breaker, The alternating current power of the distributed power source acquired from two or more generators which generate alternating current power based on the rotational energy from two or more system-interconnection converter, or two or more internal combustion and external combustion engines which supplies two or more loads connected to this distribution line through the distribution line, and changes the direct current power from two or more DC power supplies into alternating current power It constitutes so that said distribution line may be supplied through a link reactor and a power-distribution-system breaker, respectively. In the distributed power-source system equipped with two or more control units which input the network electrical-potential-difference detection value from a network detector and network current detection value which were prepared in the

upstream of each of said link reactor, and control said two or more distributed power sources The series circuit of series compensation equipment is connected with a reactor between said transmission system breakers and said distribution lines. Said each control unit Inputting an output active current command and an output reactive current command, and controlling the electrical potential difference of said distribution line uniformly, while inputting said network electrical-potential-difference detection value and a network current detection value The distributed power-source system characterized by performing an electric power supply from said distribution line to said transmission line by impressing an electrical potential difference to said transmission line by said series compensation equipment, and applying an electrical potential difference to said reactor.

[Claim 10] The power from a source power supply The transmission line, the transformer of a distribution substation, a transmission system breaker, The alternating current power of the distributed power source acquired from two or more generators which generate alternating current power based on the rotational energy from two or more system-interconnection converter, or two or more internal combustion and external combustion engines which supplies two or more loads connected to this distribution line through the distribution line, and changes the direct current power from two or more DC power supplies into alternating current power It constitutes so that said distribution line may be supplied through a link reactor and a power-distribution-system breaker, respectively. In the distributed power-source system equipped with two or more control units which input the network electrical-potential-difference detection value from a network detector and network current detection value which were prepared in the upstream of each of said link reactor, and control said two or more distributed power sources The series circuit of series compensation equipment is connected with a reactor between said transmission system breakers and said distribution lines. Said each control unit While inputting said network electrical-potential-difference detection value and a network current detection value, an output active current command and an output reactive current command are inputted. It is the distributed power-source system characterized by for one set only of said distributed power source performing armature-voltage control with said control unit, and performing an electric power supply from said distribution line to said transmission line while a distributed power source besides the remainder performs current control with a control unit besides the above and controls the electrical potential difference of said distribution line uniformly.

[Claim 11] The power from a source power supply The transmission line, the transformer of a distribution substation, a transmission system breaker, The alternating current power of the distributed power source acquired from two or more generators which generate alternating current power based on the rotational energy from two or more system-interconnection converter, or two or more internal combustion and external combustion engines which supplies two or more loads connected to this distribution line through the distribution line, and changes the direct current power from two or more DC power supplies into alternating current power It constitutes so that said distribution line may be supplied through a link reactor and a power-distribution-system breaker, respectively. In the distributed power-source system equipped with two or more control units which input the network electrical-potential-difference detection value from a network detector and network current detection value which were prepared in the upstream of each of said link reactor, and control said two or more distributed power sources The series circuit of series compensation equipment is connected with a reactor between said transmission system breakers and said distribution lines. Said each control unit While inputting said network electrical-potential-difference detection value and a network current detection value, an output active current command and an output reactive current command are inputted. It is the distributed power-source system characterized by for one set only of said distributed power source performing current control with said control unit, and performing an electric power supply from said distribution line to said transmission line while a distributed power source besides the remainder performs armature-voltage control with a control unit besides the above and controls the electrical potential difference of said distribution line uniformly.

[Claim 12] Between the 1st transmission line connected to the 1st source power supply, and the 2nd transmission line connected to the 2nd source power supply While connecting the series circuit of the

series compensation equipment between networks with the reactor between networks, connecting the distribution line to said each transmission line through the transformer of a distribution substation, respectively and connecting two or more loads to this each distribution line The series circuit which consists of a reactor and series compensation equipment through a transmission system breaker between this each load and said each distribution line is connected, respectively. The alternating current power of the distributed power source acquired from the generator which generates alternating current power based on the rotational energy from the system-interconnection converter, or the internal combustion and the external combustion engine which is formed corresponding to the load connected to this each distribution line, and changes the direct current power from DC power supply into alternating current power, respectively A link reactor, Constitute so that said each distribution line may be supplied through a power-distribution-system breaker, and the network electrical-potential-difference detection value from a network detector and network current detection value which were prepared in the upstream of said link reactor are inputted. The distributed power-source system characterized by having the control unit which controls said distributed power source, and performing power interchange between said 1st and 2nd transmission lines.

[Claim 13] The distributed power-source system according to claim 12 characterized by connecting an alternating current switch to a serial in the series circuit of the reactor between said networks connected between said 1st and 2nd transmission lines, and said series compensation equipment between networks.

[Claim 14] The distributed power-source system according to claim 12 characterized by connecting a breaker in the series circuit of the reactor between said networks connected between said 1st and 2nd transmission lines, and said series compensation equipment between networks at juxtaposition.

[Claim 15] The distributed power-source system according to claim 12 characterized by connecting an alternating current switch to a serial at these while connecting a breaker to juxtaposition in the series circuit of the reactor between said networks connected between said 1st and 2nd transmission lines, and said series compensation equipment between networks.

[Claim 16] Between the 1st transmission line connected to the 1st source power supply, and the 2nd transmission line connected to the 2nd source power supply While connecting the series circuit of the series compensation equipment between networks with the reactor between networks, connecting the distribution line to said each transmission line through the transformer of a distribution substation, respectively and connecting two or more loads to this each distribution line The series circuit which consists of a reactor and series compensation equipment through a transmission system breaker between this each load and said each distribution line is connected, respectively. The alternating current power of the distributed power source acquired from the generator which generates alternating current power based on the rotational energy from the system-interconnection converter, or the internal combustion and the external combustion engine which is formed corresponding to the load connected to this each distribution line, and changes the direct current power from DC power supply into alternating current power, respectively A link reactor, Constitute so that said each distribution line may be supplied through a power-distribution-system breaker, and the network electrical-potential-difference detection value from a network detector and network current detection value which were prepared in the upstream of said link reactor are inputted. The distributed power-source system characterized by having the control unit which controls said distributed power source, and performing power interchange between said 1st and 2nd transmission lines.

[Claim 17] Between the 1st transmission line connected to the 1st source power supply, and the 2nd transmission line connected to the 2nd source power supply While connecting the series circuit of the series compensation equipment between networks with the reactor between networks, connecting the distribution line to said each transmission line through the transformer of a distribution substation, respectively and connecting two or more loads to this each distribution line The series circuit which consists of a reactor and series compensation equipment through a transmission system breaker between this each load and said each distribution line is connected, respectively. The alternating current power of the distributed power source acquired from the generator which generates alternating current power

based on the rotational energy from the system-interconnection converter, or the internal combustion and the external combustion engine which is formed corresponding to the load connected to this each distribution line, and changes the direct current power from DC power supply into alternating current power, respectively A link reactor, Constitute so that said each distribution line may be supplied through a power-distribution-system breaker, and the network electrical-potential-difference detection value from a network detector and network current detection value which were prepared in the upstream of said link reactor are inputted. The distributed power-source system characterized by carrying out tidal-current control, having the control unit which controls said distributed power source, and carrying out armature-voltage control of all of the distributed power source of said both networks.

[Claim 18] Between the 1st transmission line connected to the 1st source power supply, and the 2nd transmission line connected to the 2nd source power supply While connecting the series circuit of the series compensation equipment between networks with the reactor between networks, connecting the distribution line to said each transmission line through the transformer of a distribution substation, respectively and connecting two or more loads to this each distribution line The series circuit which consists of a reactor and series compensation equipment through a transmission system breaker between this each load and said each distribution line is connected, respectively. The alternating current power of the distributed power source acquired from the generator which generates alternating current power based on the rotational energy from the system-interconnection converter, or the internal combustion and the external combustion engine which is formed corresponding to the load connected to this each distribution line, and changes the direct current power from DC power supply into alternating current power, respectively A link reactor, Constitute so that said each distribution line may be supplied through a power-distribution-system breaker, and the network electrical-potential-difference detection value from a network detector and network current detection value which were prepared in the upstream of said link reactor are inputted. The distributed power-source system characterized by carrying out tidal-current control, having the control unit which controls said distributed power source, and carrying out phase control of all of the distributed power source of said both networks.

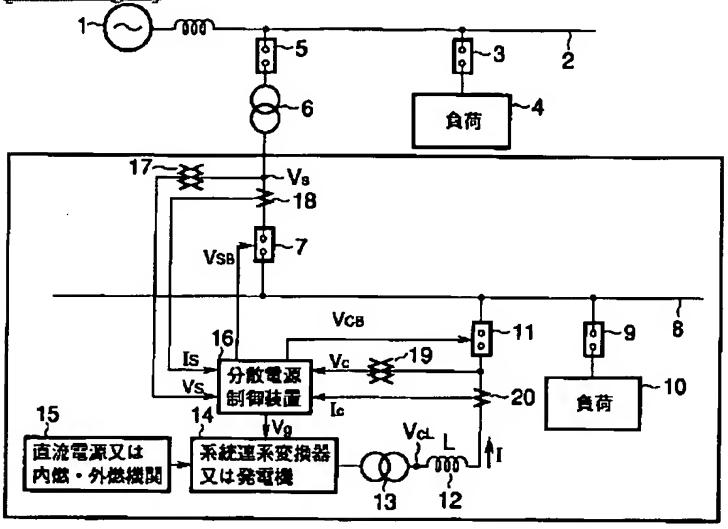
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



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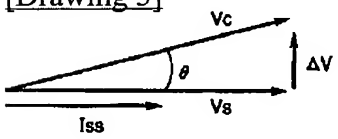

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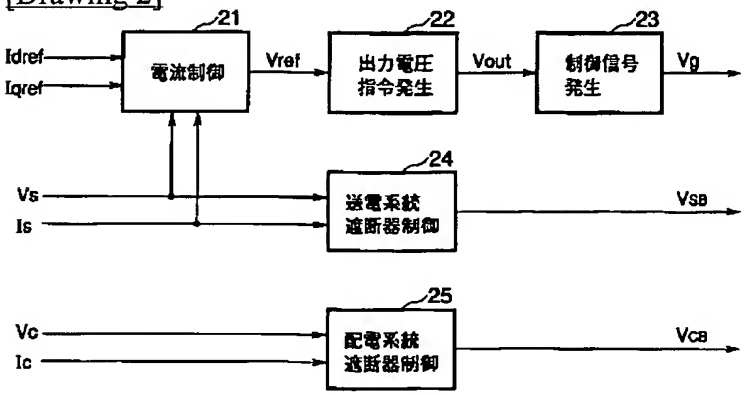

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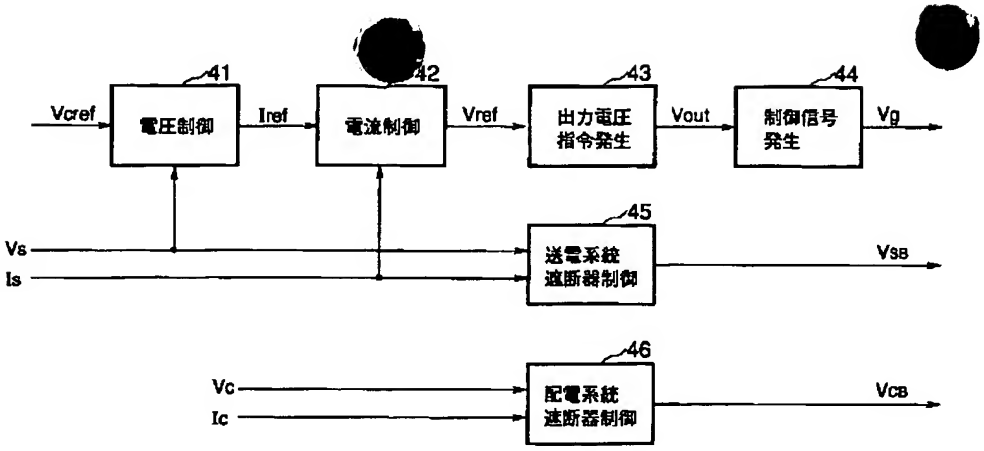

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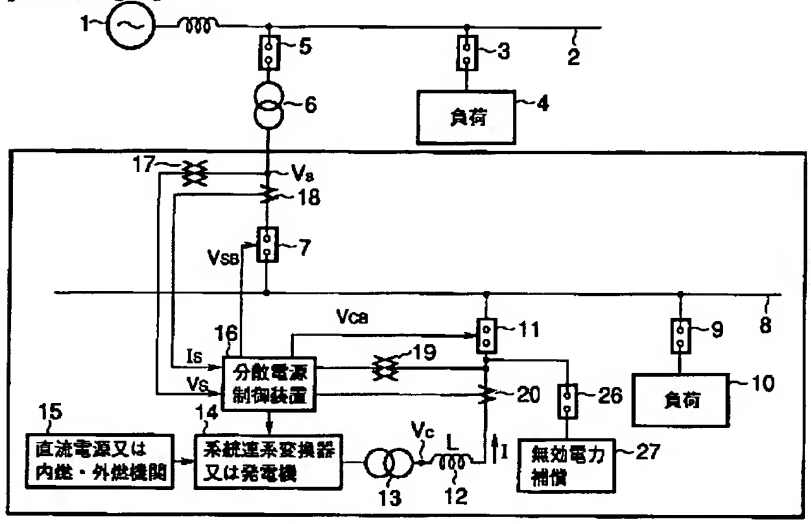

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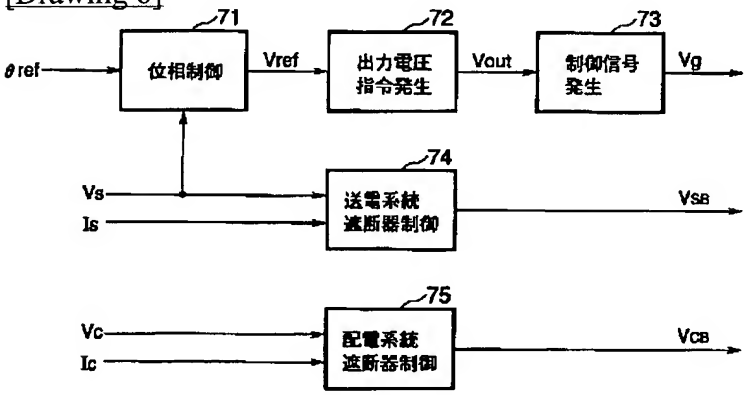

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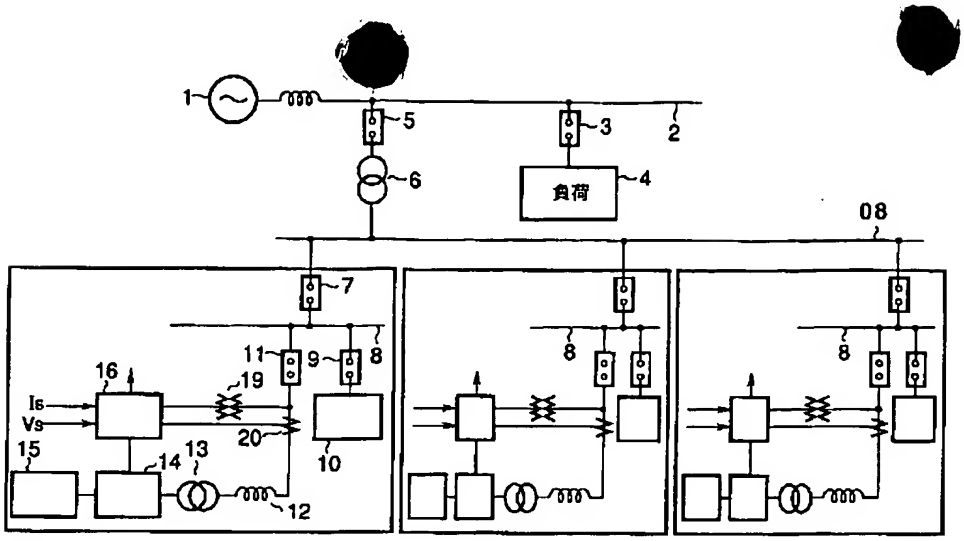

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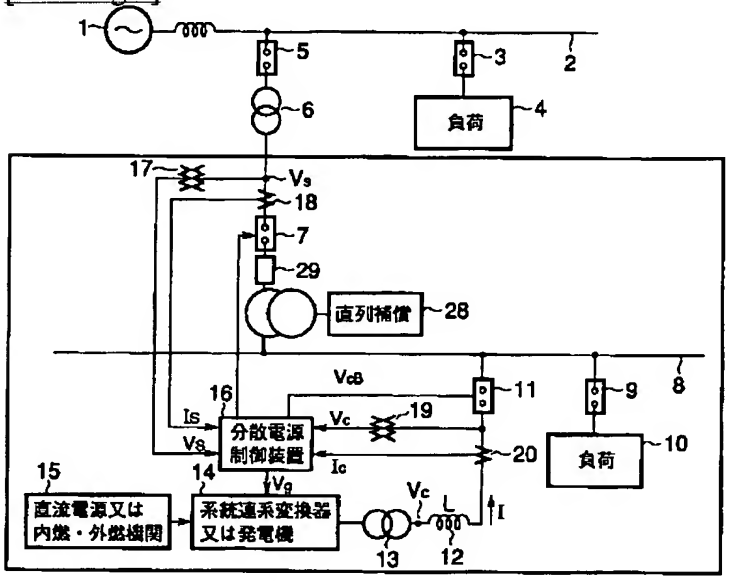

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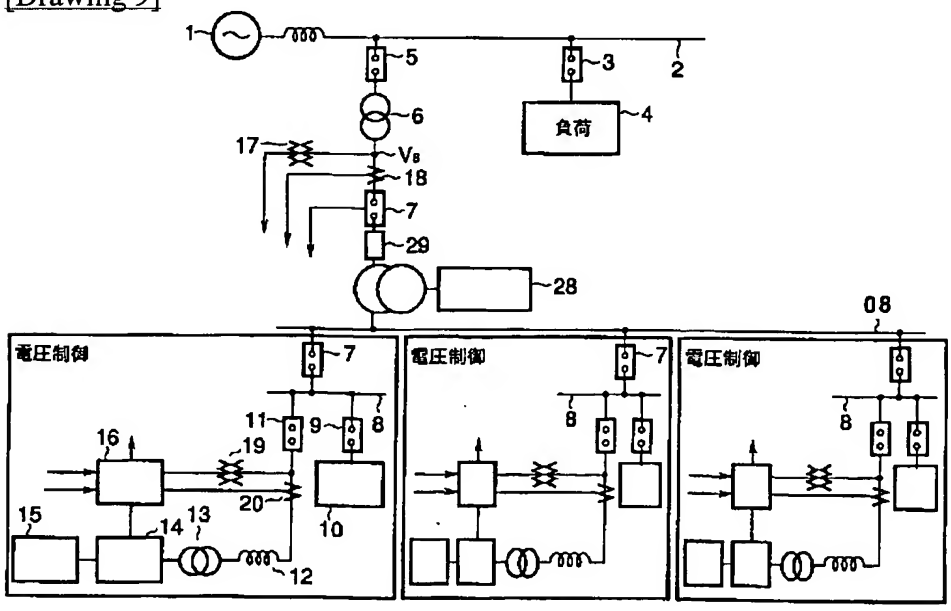

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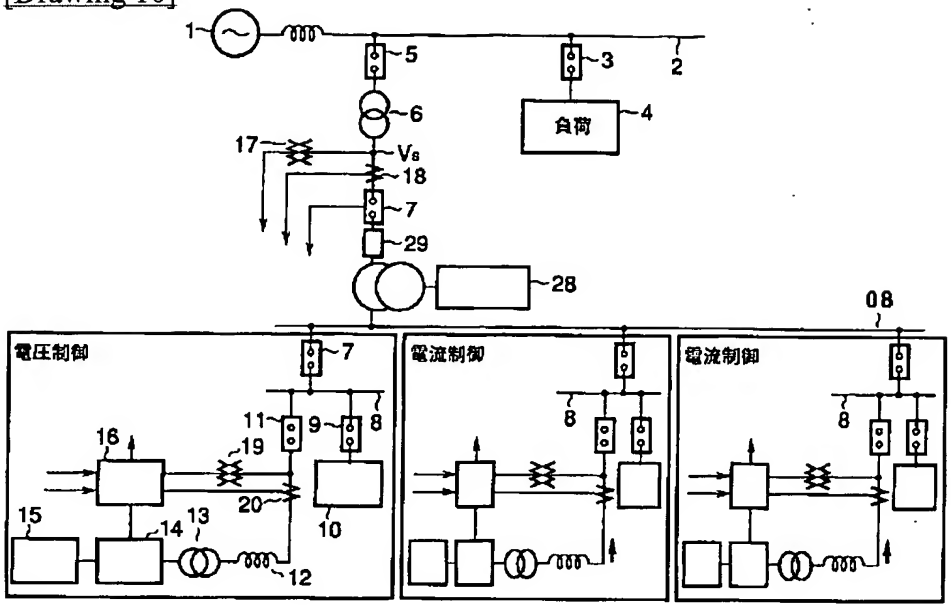

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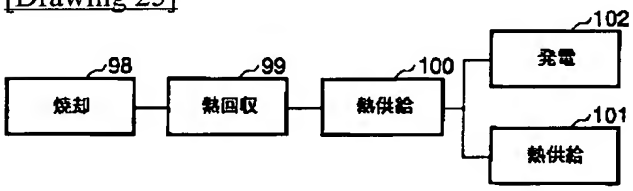

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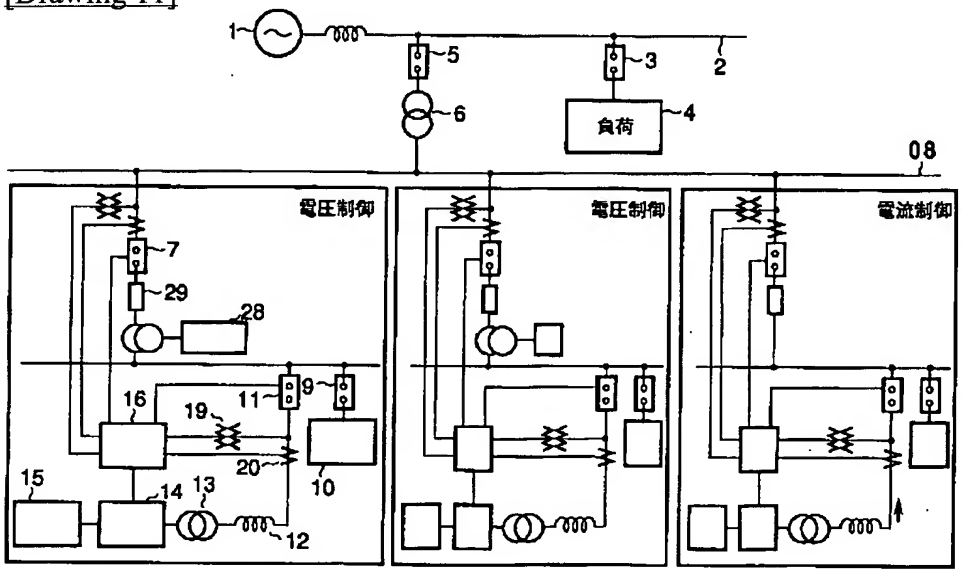

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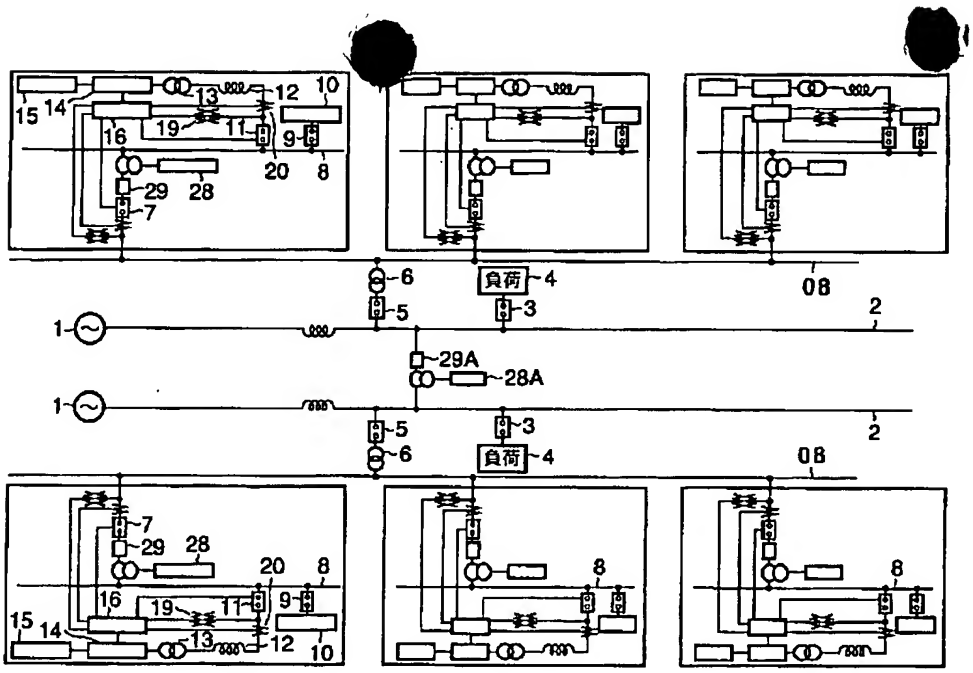

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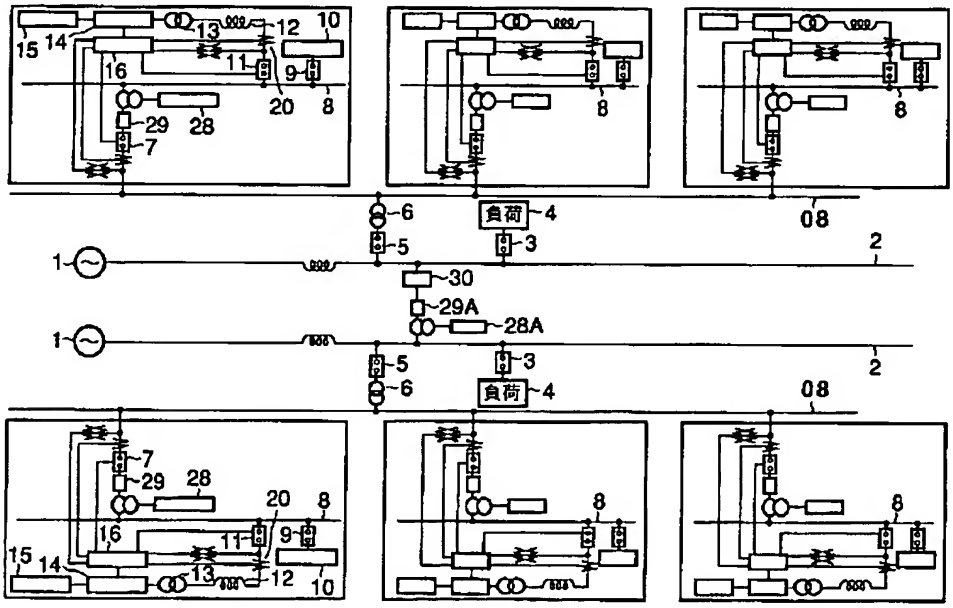

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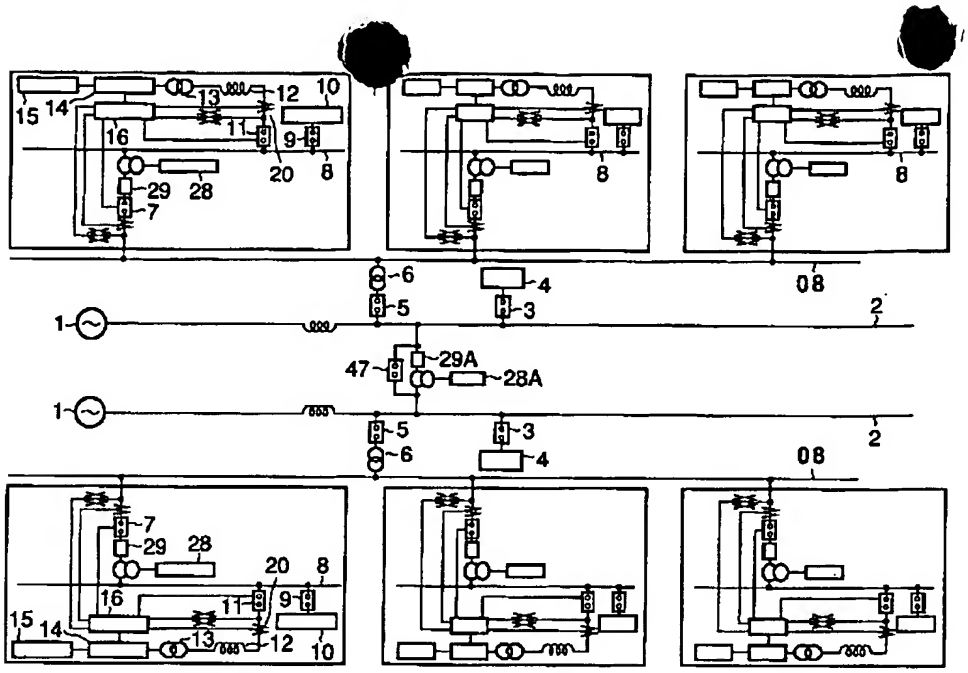

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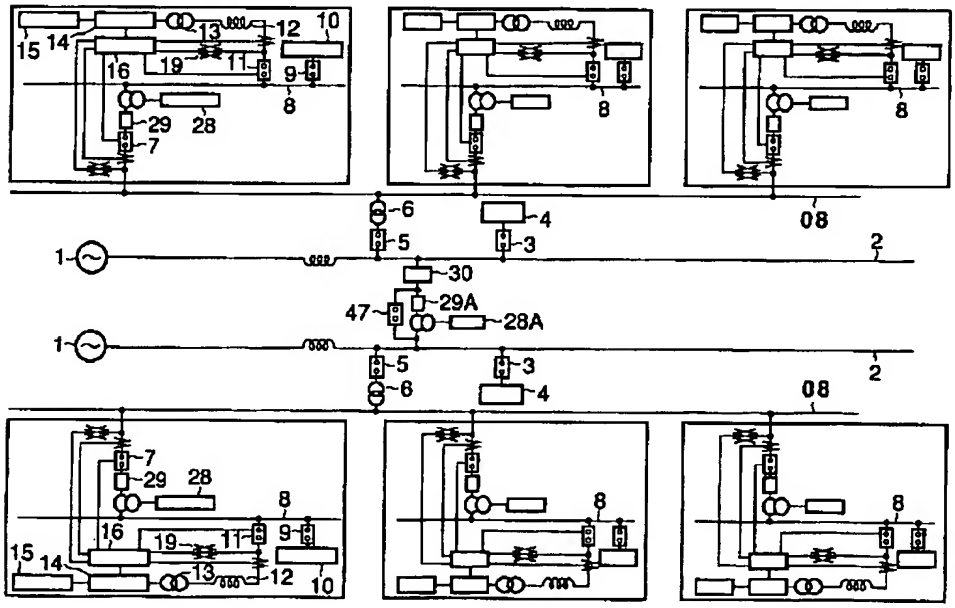

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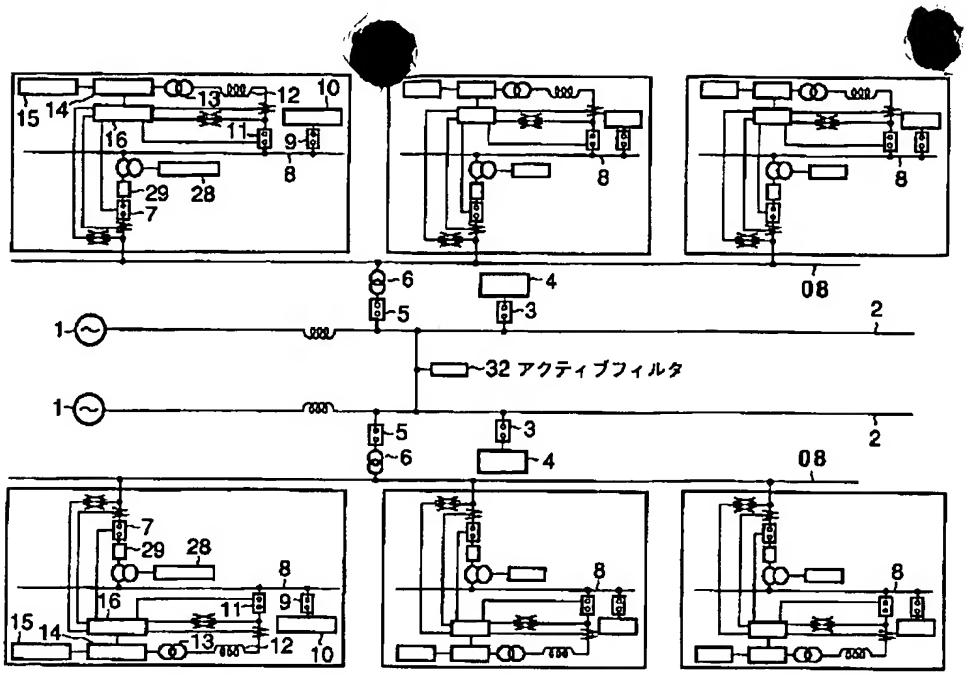

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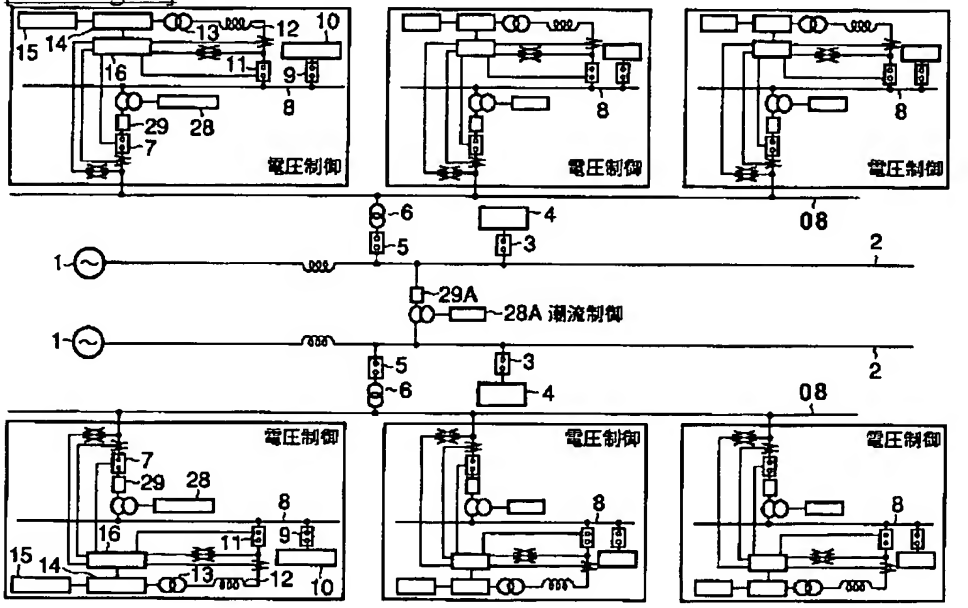

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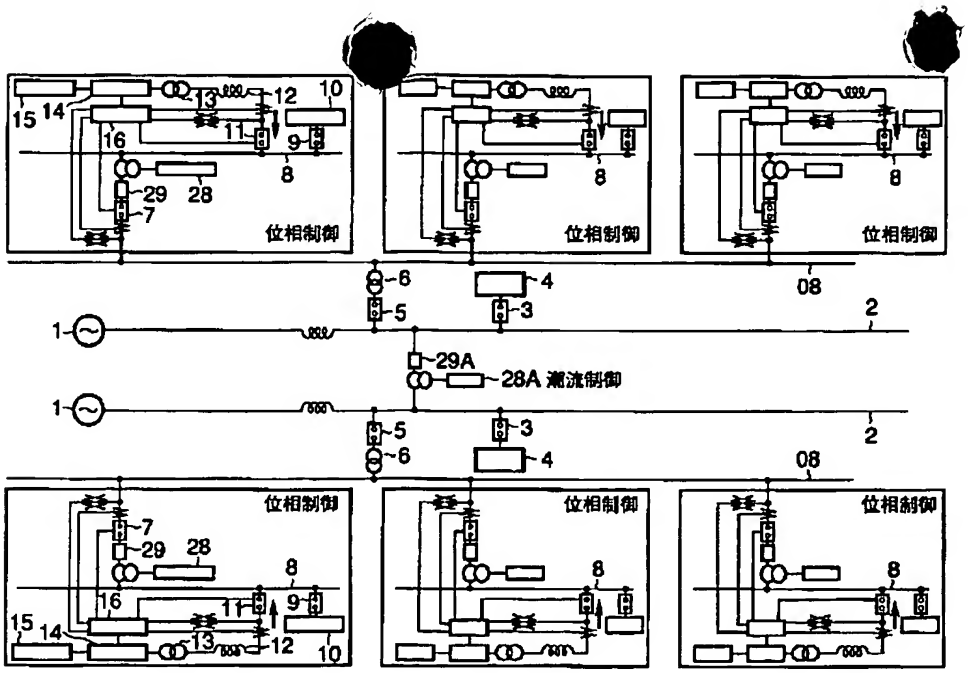

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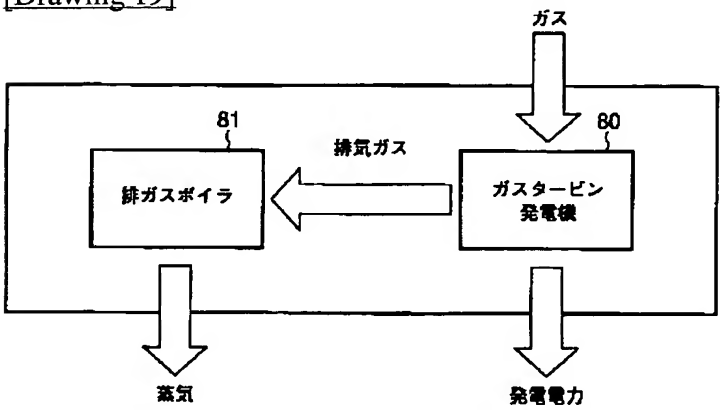

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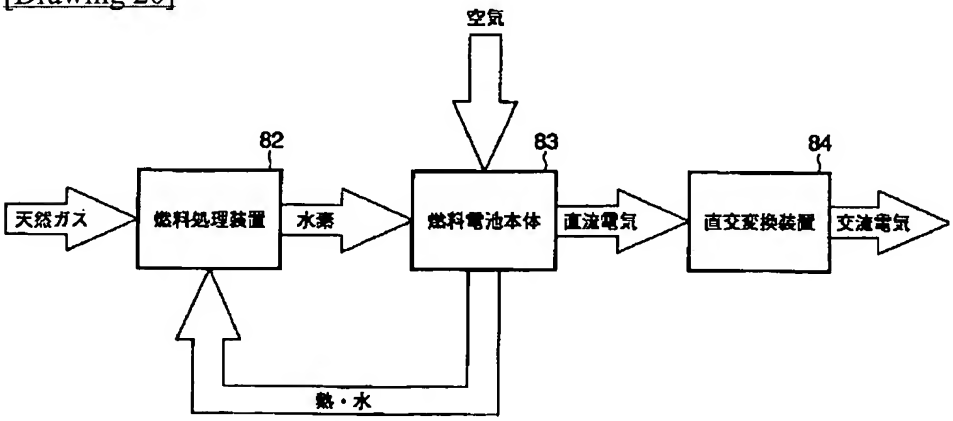

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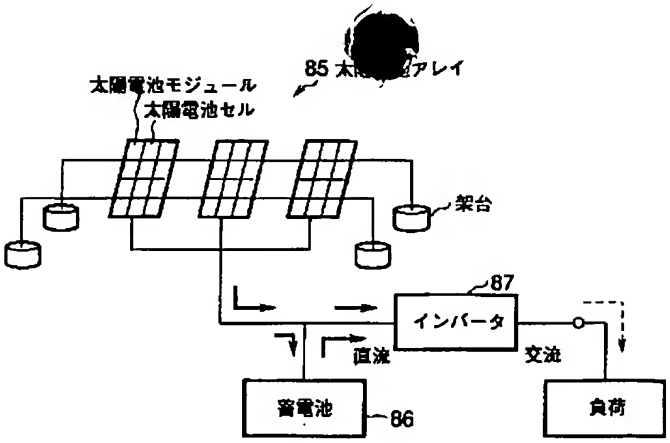

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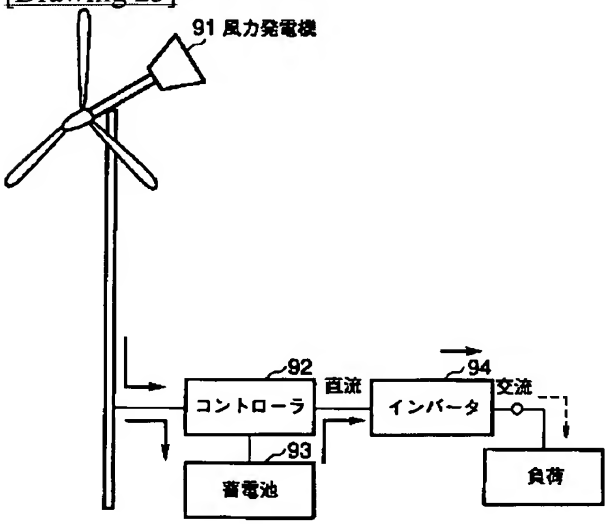

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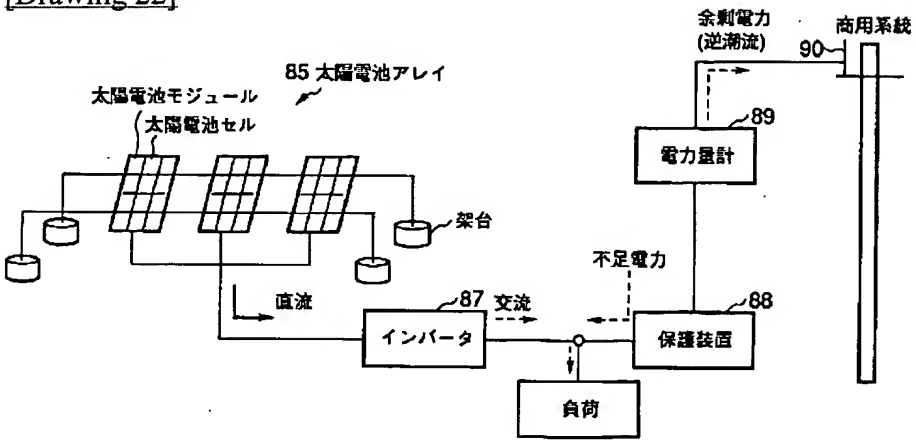

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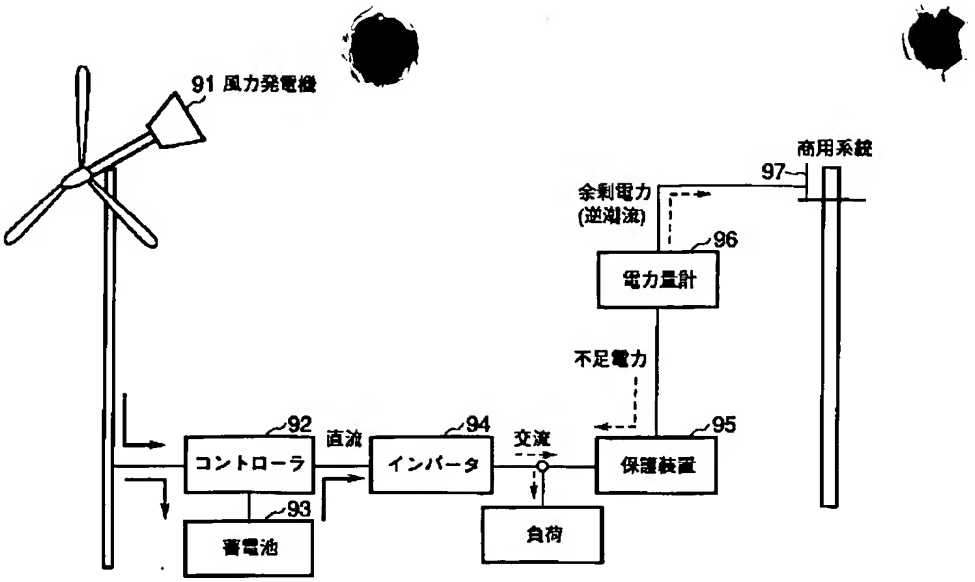

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